THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

J. A. BERLY'S).

1911 EDITION

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THE I.E.E. AND ITS FUTURE.

THE annual Report of the Council of the I.E.E. this year opens in a minor key; rarely, if ever, we should think, has it contained such a lengthy roll of names well known in the electrical world as one year's harvest of the Reaper. Perusing this mournful list, it is brought home to us that electrical engineering is indeed no longer in its infancy, and that old comrades are falling out of the ranks all too quickly. Forty adherents to the Institution have closed their account with Nature during the year. On the other hand, no fewer than 116 resignations in the various classes are reported, and the membership has made a net increase of only 152. It is noteworthy that decreases are recorded in the classes of Associates and Students; the loss in the latter is, doubtless, due to the reaction which has set in in recent years, and which we have already commented upon as evidenced by the falling-off in the numbers of students attending the electrical Engineering Departments of our Technical Colleges. This movement, we presume, indicates that the congested state of the market for technically-trained electrical men has become known to the public, who are diverting their progeny into other paths.

All will agree that it is highly desirable that the titles of Member and Associate Member of the Institution should be or should become unquestionable proofs of the possession of a high standard of electrical knowledge and experience. In this connection we note with satisfaction that after January 1st, 1913, candidates for the class of Associate Member will be required to give proofs of their possession of a sound general education, and of their proficiency in one or other of four branches of electrical engineering.

There are many other points of interest in the Report, upon which we cannot dwell at present; but, in conclusion, we wish to touch upon the general policy of the Institution. Many indications have been given of increasing vitality and activity on the part of the Council in recent years, and we do not wish to underrate the value of its efforts; but that there is a widespread feeling amongst the members that the Institution still falls short of realising its opportunities to the full, is beyond question. Fixing its gaze upon a high scientific ideal, the Council is apt to lose sight of mundane affairs, and we have the authority of the President himself—worthily honoured by a second term of office—for the contention that the Institution does not do enough for its members. We do not suggest that the Institution should degenerate into anything of the nature of a Trade Union; but undoubtedly there is abundant scope for its influence to be exerted in support of and on behalf of its members *as individuals*. We have already mentioned the small net increase of membership, which took place in spite of the acquisition of a most convenient and commodious building for head-quarters, the advantages of which are probably far from being

fully realised as yet by those entitled to avail themselves of them. To what is this slackening due?

It is a fact that mechanical engineers are more and more combining a large proportion of electrical knowledge with their customary training; the Institution of Mechanical Engineers, one of the most alive and enterprising bodies in this country, appreciates the fact and shapes its course accordingly. The summer meeting, for example, of that Institution will be held this year in Switzerland, where something like 400 members will inspect the huge hydro-electric installations there to be found. Last year the summer meeting was devoted largely to the subject of electrical traction on railways. Is there not some danger that engineers—even electrical engineers—not slow to perceive where their interests lie, will find it to their advantage to join hands with their mechanical brethren, unless they can obtain from the I.E.E. more certain and effective benefits? We commend the matter to the notice of the Council, and of all the members of the Institution of Electrical Engineers, in the hope that the hint may serve, and that such steps may be taken as will ensure that the attractions of the Institution shall be paramount, and that membership of the I.E.E. shall be a *sine qua non* to every member of the electrical profession.

Fibrous Insulating Materials.

Insulating materials for electrical machinery require to be considered from several aspects. In the past considerable attention has been given by a number of persons to dielectric strength, and also by a Sub-Committee of the British Engineering Standards Committee, to the effect of heat. An "original communication" on the hygroscopic susceptibility of such materials by Mr. W. Pollard Digby, which was published in a recent volume of the *Proceedings* of the Institution of Civil Engineers, deals with the effect of moisture. The laboratory tests described are certainly of a drastic order, but the standard test of comparison of exposure to a saturated moist atmosphere at 75° C. for a definite time does serve to discriminate in a marked degree between materials superficially similar. This is, of course, only one aspect of the case; it applies only to motors, generators and air-cooled transformers, which are likely to be used in most climates, and particularly where the plant may stand idle for hours or days at a time.

There are fashions in insulating materials, as well as in other branches of engineering work. Press-spahn, for instance, which was at one time the most widely used of the fibrous non-woven materials for dynamos and motors, is now but little used on this class of work. For oil-cooled transformers, if thoroughly dry before immersion in the oil, it has still a wide field of usefulness. The latest modern practice for motors, &c., with voltage in the neighbourhood of 500 volts, is to rely upon mica or micanite slot linings, these being protected against mechanical injury by an external sheathing of compressed fibrous material.

Mr. Digby's important contribution is only a stage in the study of one class of the materials of electrical engineering. As industries become firmly established, practice tends to become standardised and materials receive detailed investigation. There is a great deal yet to be learned about insulating materials, in particular as to the loss of mechanical properties such as tensile strength, cohesion and flexibility, always found to a greater or less extent when, after some years of use (or misuse), an armature comes into the shops for rewinding. While it will be difficult to devise tests which, at the end of a few days, will simulate the results of years of work, this should not be impossible.

Electrical Publicity.

The receipt last week of another batch of literature from the Electricity Supply Publicity Committee reminded us that this body had been in existence nearly 12 months. We have since had a further reminder in the first annual conference of the Committee, which was held on Tuesday at the I.E.E.

Mr. Renwick, the Chairman of the Committee—which has now extended the scope of its activities to the whole of Great Britain—was naturally enthusiastic regarding its prospects, and if we cannot quite agree with him that (as the *Financier* puts it) the universal use of electricity in the house is only a question of making the facts known to the public, we are certainly at one with him as to the laudable object in view.

At the time of its inception we ventured to urge the necessity for forming a complete business-getting organisation for London rather than a publicity or advertising Committee only—organised effort being then, as now, the great need of the London electric supplier.

Needless to add, we are still of opinion that no piecemeal methods can effectively deal with the situation in London; indeed, the capital at stake in electricity supply, and the organised opposition of gas, seem to leave little option in the matter.

Our object in touching on the subject again is primarily to remind the Committee that even publicity methods offer a wide scope for development, and need not be confined to paper and printer's ink; indeed, we have often thought that the cinematograph theatre—the electric theatre, as it is appropriately called—offers considerable opportunities for instructing a large section of the population which cannot be reached by other methods; an "electric" film would not be inappropriate in an electric theatre, and certainly it need not be one bit less interesting than other films.

Again, there seems to be no valid reason why the Committee, with the assistance of the manufacturers, should not include actual demonstrations in conspicuous showrooms amongst its channels of publicity.

To save the Committee time and trouble we would suggest the vicinity of the gas companies' excellent showrooms as suitable situations.

The station engineer is apt to take it for granted that "everyone worth having knows about electricity," whereas the fact that gas consumers number about 20 to each electricity consumer plainly contradicts this theory.

It must be remembered that the gas companies' domestic business is well established; the electricity suppliers are only entering this important field, and they are unlikely to get very far unless they abandon the present system of microscopically examining each individual consumer, on his merits, in favour of a broader-minded consideration of the consumer in bulk, or possibly of the street as a whole.

A New Trade Union Bill.

It is the fate of those who at present hold the reins of office to be compelled to do something to secure the reversal of the famous Osborne judgment. The trade unions, or at any rate the more militant among them, desire to be allowed to apply their funds "for or towards the purpose of procuring the return and providing for the maintenance of Members of Parliament or public or local authority, or of any other public body, and may do such other acts as may be necessary to forward the interests of workmen by political action or otherwise." That is the text of the Bill put forward by the Labour Party in February last. But the Government do not intend to "toe the line" to this extent. The Bill recently introduced by Mr. Winston Churchill makes it lawful for a trade union to apply certain of its funds to political purposes—including those above enumerated—but it expressly provides that these funds are to be separated from the main funds of the union. Nor can members be compelled to subscribe. Further than that, the non-subscribing member is to be immune from attack. Thus he must not be excluded from any benefits of the union, or placed in any

respect either directly or indirectly under any disability or at any disadvantage as compared with other members of the union (except in relation to the control or management of the political fund) by reason of his being so exempt. Again, contribution to the political fund of the union must not be made a condition for admission to the union. These safeguards against oppression are all very well in theory, but how are they to be applied in practice? A political fund cannot be started by a union unless the scheme is approved by a majority of the members. So long as each member has an equal opportunity of recording his vote, it matters not whether the majority is 1 or 500. The ballot must be secret. So far so good. A man may vote against his union taking part in political work, and no one need know that he did so. But if it is decided to form a political fund, the member who objects to subscribe to it for conscientious or other reasons, must give written notice of the fact. We can foresee the use which will be made of notices so given. Under the rules they will be "screened" at the head office, or published in its official journal, and those who gave them will be held up to obloquy.

It is often said in courts of law that the court "will not do a vain thing." No judge will make an order which he cannot enforce. The fact that the High Court of Parliament at times makes orders which cannot be enforced tempts one to look for *vis a tergo* which prompts its action. The Bill may protect a man from overt official action, but it does not cover those more subtle methods of annoyance which the ardent unionist knows so well how to employ. Suppose a schoolboy were entitled to give notice that he would not subscribe to the games fund, and that, according to the written laws of the school, he were to be subject to no disability in consequence, could the other boys be prevented from sending him to Coventry?

For our part, we see in this new piece of trade-union legislation one further step towards the break-up of the militant unions. The average workman wants his union to insure him against low wages, unemployment in trade disputes, and sickness. He does not want his money spent on political propaganda. It is the union which will refuse to be led into these by-paths that will secure new members in the future.

Electricity in Iron Works.

THE spring meeting of the Verein Deutscher Eisenhüttenleute, which has just been held at Dusseldorf, was notable for an interesting paper by Chief Engineer Hoff, of Düdelingen, dealing with the problem of generating and transmitting power in iron works. Mr. Hoff had circularised the great iron works of Germany and Luxemburg, which have electrical generating plants installed, and from the 29 answers received, he concluded that gas plant was utilised for generating power in about 38 per cent. of the works. In some of the works, 22 per cent. of the power employed is generated by gas-driven machinery, while in one works the figure is 51·7 per cent. Mr. Hoff announced it as his conviction that electric power could be produced more cheaply with steam turbines than with gas engines. He expressed doubts as to whether iron works should resort to electrical transmission as was being done at present by most of them, particularly in view of the progress being made in rendering the steam engine more economical in operation. He also drew attention to the fact that German engineers, as a consequence of the development of the large gas engine, had apparently lost interest in efforts to improve steam plant. In establishments with large electrical generators driven by gas engines, it was often found that the boilers were operated at a pressure of only five or six atmospheres, and that superheating was done only to a limited extent. Owners of antiquated steam plants were seldom willing to displace them with modern machines. However, one could now hear of establishments ordering steam engines, which had hitherto adopted the principle of running everything electrically. Mr. Hoff next referred to the practice of utilising furnace gas under boilers, and to the merits of exhaust turbines. He described a plant which had been in operation at Düdelingen for a year, utilising the exhaust from high-pressure plant.

SOME METHODS OF SUSPENDING ARC LAMPS.

BY S. LEES.

IT is a curious fact that, notwithstanding the really remarkable progress shown in the design of street arc lamps during the past decade, the methods of suspension still used by the majority of makers, to use a commonplace, leave much to be desired. Whereas, in the earlier days, the suspension devices were of almost ridiculously robust proportions, warranted, perhaps, by the heavier weight of the average arc

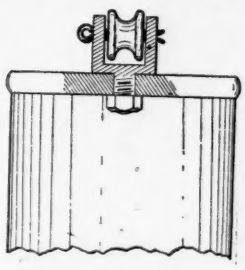


FIG. 1.

lamp then used—now, we find most lamps, not even excluding those of so-called high-class make, fitted with suspension attachments of the most flimsy and unmechanical character, altogether unsuited for service under outside atmospheric conditions. Such a state of things seems almost incredible, considering that so much — the life of the lamp in a manner of speaking—depends on the security of its suspension fastening. It is at once a detail so simple and inexpensive, that the question of cost cannot be considered as an excuse for what can hardly be characterised as anything but neglect in not providing a safe and securely constructed arrangement for the heavy duty which is undoubtedly placed on this accessory to the street arc lamp.

The accompanying sketches, which are really self-explanatory, illustrate some of the methods employed in the suspension of quite modern arc lamps. Fig. 1 is typical of a device greatly favoured by many makers, at least judging

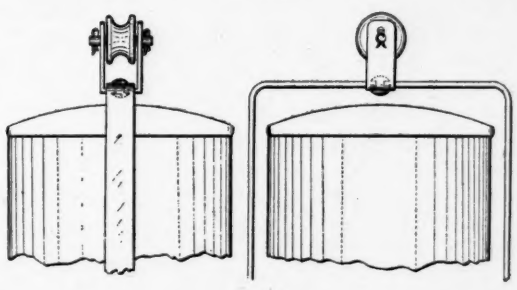


FIG. 2.

from the number in use. A cursory glance will reveal the weakness of the arrangement. A form of shackle, usually of cast-iron, and in some few cases of brass, is fitted to the crown plate of the lamp, as shown.

The insulator, almost invariably an earthenware bobbin, is attached thereto by means of a split-pin or cotter, and often no consideration appears to be shown to the proportioning of the said pin to the size of hole in the shackle and insulator. When, as frequently happens, the insulator fails, the split-pin is unable to withstand the strain thus imposed on it *under the altered conditions of load*, and the inevitable follows. The device shown in fig. 2 is faulty, and is to be deplored more, considering the otherwise really good lamps on which it has been adopted. Imagine a weight of some 60 odd pounds avoirdupois, hanging by a U-shaped piece of metal measuring less than 1 in. in width, and of barely $\frac{1}{8}$ in. thickness, bent sharply round the lamp frame and held by one small rivet. No wonder grooving quickly develops at the sharp bends, and it is then simply a question of time as to

which gives out soonest, the latter or its rivet. Fig. 3 illustrates an attachment which is largely used, and whilst being of better mechanical design than either of the types described above, it has one weak point. Unless the lamp is securely anchored to withstand movement caused by atmospheric

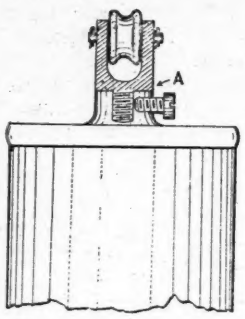


FIG. 3.

changes—and this practice is by no means common—the constant moving of the lamp about its parts in contact, indicated by the letter A in sketch, results in wear, the action of which, assisted by the oxidation always present, more or less, causes the screwed or pinned attachment to fail.

The methods of hanging street lamps so fitted, to the brackets or pole erections, would seem, if anything, to be worse than the devices already described. In many cases a

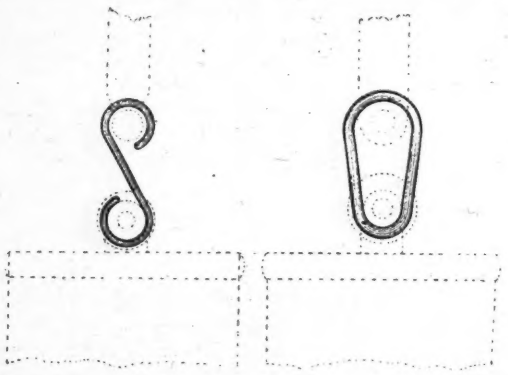


FIG. 4. FIG. 5.

simple form of metal hook, fashioned S shape, as depicted in fig. 4, is used. For any but the light forms of indoor lamp, such a practice cannot be too strongly condemned. Another well-known device is that of a cast metal ring, illustrated in fig. 5. The ring, originally circular in shape, is pressed over the insulator fitting, and then distorted elliptically. To replace a broken insulator it becomes necessary to again

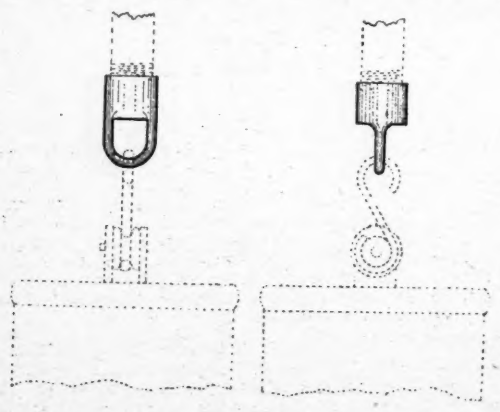


FIG. 6.

distort the ring, and afterwards close it to effect locking of the insulator. Repeated operations of this kind obviously cause crystallisation of the metal, and subsequent failure of the ring, in all probability unnoticed at the time, which is all the more serious. The arrangement described in fig. 6 is bad, as, with a lamp free to move about its centre, there is liability for the coupling to become unscrewed. As this form of attachment is almost invariably used in conjunction with a hook of the S variety already mentioned, the combination is doubly bad, owing to the excessive movement of the lamp in boisterous weather.

The list of faulty and ill-designed lamp suspension devices could be easily extended, but the writer forbears in consideration of space limits. The foregoing have been described

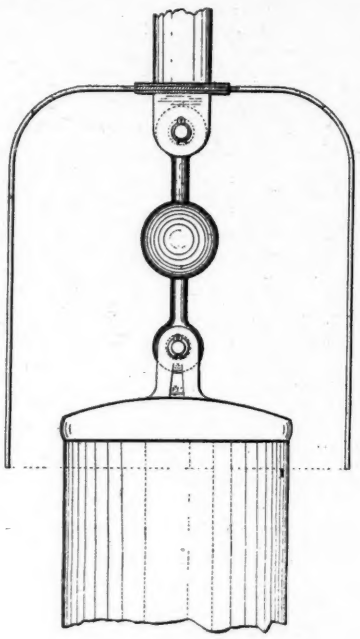


FIG. 7.

mainly with a view of drawing attention to a much-neglected detail, perhaps seemingly small and unimportant at first thought, but, none the less, one fraught with much responsibility.

In the course of his experience, the writer has found a simple suspension device, at once cheap and applicable to almost every make and type of arc lamp. He has before, through the medium of the technical Press, advocated the use of the well-known strain insulator—the globe pattern is very suitable—for suspending arc lamps. Its application, illustrated in fig. 7, shows how peculiarly fitted the device is for this purpose. This type of insulator has proved its worth and reliability adequately under the exacting conditions of tramway work for many years past, until to-day it is recognised as the standard form of insulator for this class of service. Given a suitable, properly-made attachment, preferably galvanised, in the lamp itself, the globe-strain insulator provides an ideal combination for the suspension of arc lamps, particularly those employed for outside illumination.

Messrs. Bennis's Activity.—We have received from MESSRS. ED. BENNIS & CO., LTD., of Little Hulton, Bolton, an imposing list of contracts (including many "repeats") that have recently been occupying the attention of the firm. They cover a wide variety of industries for which their plant is designed, including textile mills, cotton spinning mills, dyeing and bleaching works, chemical works, machine works, flour mills, paper mills, collieries, ironworks, steel-rolling mills, engineering works and municipal electricity works.

The greater appreciation of the economic value of elevators and conveyors, as adjuncts to machine stokers, is borne out by the considerable increase in this kind of plant. We select the following from the list:—

Borough of Sunderland Electricity Department, Hylton Road Works.—Eight "Bennis" mechanical stokers and self-cleaning compressed-air furnaces for Lancashire boilers, to replace another make of stoker.

Kettering U.D.C. Electricity Works (per Messrs. Kennedy & Jenkin).—Two "Bennis" stokers and self-cleaning compressed-air furnaces for a Lancashire boiler; also an independent coal elevator and driving arrangement. (Repeat order.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Not Water-Gas.

I have pleasure in giving herewith the result of an earth leakage, which is one of the most remarkable I have ever met. I have seen many peculiar results due to this cause, and previously to the present case I met with an earth which caused a small fire two houses away from the actual earth. The strange thing was that the house where the trouble arose had no electricity connected to it. In the present case a $\frac{5}{8}$-in. iron gas pipe crossed in close contact with a $\frac{3}{4}$-in. lead water main, the walls of which were $\frac{3}{16}$ in. thick. The current fused a hole in the lead pipe and also in the gas pipe simultaneously, and it was not discovered until someone turned on a gas jet and found that they had water instead of gas; the fusion of the pipes was so nearly perfect that it connected the water main to the gas-pipe, bringing about the results described. I may add that the pipes did not unite perfectly, and there was a leakage of water at the junction, which no doubt put out the arc.

I shall be pleased to exhibit the two pieces of pipe to anyone interested.

W. R. Rawlings.

London, S.W., *May 22nd*, 1911.

Induction on Telephone Circuits.

Your correspondent "Cheshire" does not state the following points, which are of great importance, viz. :—

Will the proposed power lines extend the same length as his telephone lines?

What distance will the proposed power line be away from his telephone lines?

What volume of current is likely to be transmitted by the proposed power line?

Assuming that the telephone and power lines will be on the same side of the road and close together, I suggest the two following methods :—

(*a*) Convert the single lines to metallic circuits.

(*b*) Insert translator coils in the speaking circuit of each telephone.

The above, although not completely ridding the lines of induction, should materially reduce it and allow of the efficient working of the telephones. I would also suggest the insertion of H.T. fuses and protectors as a safeguard in each line.

Horace Lavy.

London, W., *May 23rd*, 1911.

In reply to your correspondent, who is justly concerned about his single-wire telephone circuits and the inductive effects which the proposed 10,000-volt alternating-current transmission lines may have upon them :

The writer, who has had a good deal of experience on the subject abroad, can vouch for "Cheshire" getting plenty of induction from this cause, which may at times be enough to render his telephones useless, as they are at present connected and working.

In the first place, I wish to point out to him that telephone lines running together over long distances should never be single wires to earth circuits, whether there are outside disturbing influences present or not. Such construction is antiquated, and is no longer recognised or admitted by telephone authorities and experts. No doubt there are a great many *short* single-wire lines working everywhere, and giving sufficiently good results, but only in very exceptional cases are single-wire lines erected over long distances.

I would, therefore, advise him to "loop" all his lines, *i.e.*, make them into metallic circuits throughout, and either to *transpose* each pair of wires, or *rotate* them, after modern practice.

In the U.S.A. and countries abroad, where aerial power lines parallel the telephone lines for any distance, the power wires, as well as the telephone wires, are transposed at chosen intervals, the locations being generally decided upon for each particular case.

It is, of course, understood that both wires forming each telephone loop should be carefully balanced as regards inductance, capacity and resistance, also special attention should be given to the insulation, *i.e.*, removal of all tree grounds, renewal of broken or defective insulators, &c., to obtain the best results.

To accomplish this, both wires require to be of the same gauge and material, they should be transposed every $\frac{1}{4}$ mile or so, and strung upon efficient insulators, clear of tree or other ground contacts.

Since the power company have not yet erected their lines, perhaps "Cheshire" could induce them to transpose their wires during erection, along the section where they will parallel the telephone lines, but this will be of no use if he does not loop his lines also, as indicated.

In the end, it is believed that if the above advice is carried into effect and the lines of both systems are maintained in good order, there will be no trouble experienced from induction.

The looping of the telephone lines will also certainly produce a marked improvement over the present working.

C. A. S.

Sag of Line Wires.

Your correspondent who wished to hear of a simple method of measuring the sag of an overhead line may be pleased to know that if two adjacent spans of equal length be found, and the conductor be untied from the insulator on the middle pole, the sag of the double span will be four times the sag for a single span. The former sag is simply the distance between the insulator and the untied wire, which can be readily measured, and one-quarter of this is the normal sag for the single span. The factor is 4 and not 2, as the sag increases as the square of the span. I believe this is a method of measuring sag well known to engineers.

J. B. Sparks.

London, N.W., *May 23rd*, 1911.

Cleaning Porous Pots.

Would anyone kindly answer the following :—

I have a lot of porous pots that have been in use in Leclanché cells; they are all stuck up with sal-ammoniac. What could I get to clean these, so as to be able to use them again?

W. C. Sutton.

Beckermet, *May 29th*, 1911.

A USEFUL INTEGRAL.—In the letter by "W. M. M." published in our last issue an unfortunate misprint occurred; the writer was made to say "That is quite horrible;" what he really wrote, of course, was "possible," not "horrible." —EDS. E. R.

Coronation Devices.—MR. F. GOOCH, of 12, Beauchamp Street, Holborn, London, E.C., is bringing before those who are interested in Coronation electrical illumination materials a new weather proof metal reflector ("The Crown"), which has been designed for easy fixing to ordinary lampholders. The reflectors are furnished in five colours—red, white, blue, green and gold, and a special quality at a slightly higher price, in white enamel. The colouring of the reflector obviates the use of specially coloured lamp bulbs. We understand that some thousands of "Crown" reflectors are being used for one of the largest schemes of decoration now being carried out in London.

Brush Turbine Contracts.—We are informed that exceptional activity continues in the steam turbine department of the BRUSH ELECTRICAL ENGINEERING CO.'S works at Loughborough. The orders now being executed for Government, municipal and electric supply companies' stations include the following: Two sets of 1,200 KW. for the Admiralty; three of 1,200 KW. for Edinburgh; two of 3,000 KW. for the North Metropolitan Co.; a 2,000-KW. set for the Birmingham and Midland Co.; 1,000 KW. for Walthamstow; 650 and 400 KW. for Luton; 450 KW. for Kettering, Folkestone and Ballarat; and 300 KW. for Banbury; besides a much larger number of orders for private industrial undertakings.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A New Tramway Controller.

For tramway service a simple form of control apparatus is essential, in order that a driver in case of emergency may instinctively do the correct thing to avoid accident. Very reliable and simple

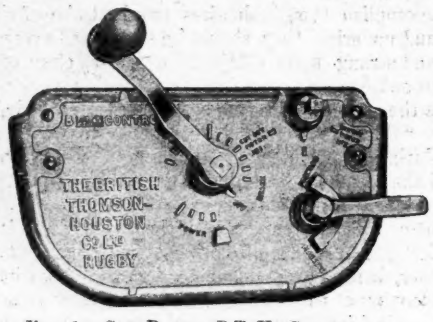


FIG. 1.—CAP PLATE, B.T.-H. CONTROLLER.

forms of controllers have been in use for many years, but in one respect, viz., that relating to rheostatic braking in the event of a car running away backwards, considerable improvements are possible.

Controllers of the braking type now in use are usually arranged so that, if the car is running in a forward direction, on moving the handle to the brake notches, currents are generated in the motors, producing a retarding torque, the direction of the currents

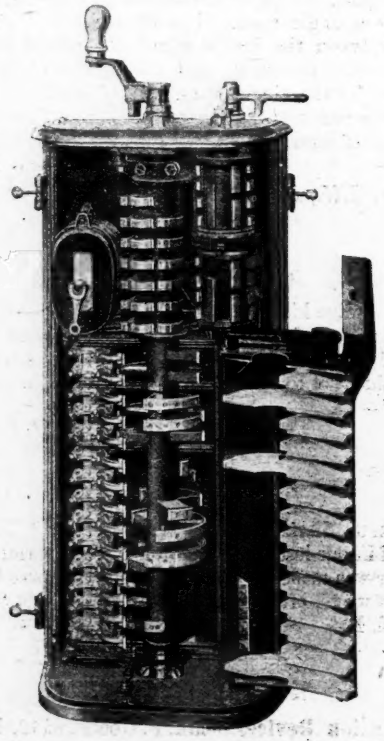


FIG. 2.—INTERIOR OF NEW B.T.-H. CONTROLLER.

in the motors being such as to strengthen the magnetism of the fields. If, however, the car is running backwards, and the controller handle be moved to the brake notches, the direction of the currents generated in the motors is such as to demagnetise the fields, so that no braking effect is produced.

To obtain a braking action when the car is running backwards, the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have designed, and are manufacturing, controllers in which, when the controller handle is moved to the "off" position, connections are made which cause one or more of the motors to act as generators, producing the desired effect. These connections are such that no braking action is obtained during forward running of the car if the handle is in the "off" position. An arrangement preferable to this, however, is one in which the motion of the control handle, which produces braking for forward running will also produce braking for backward running. The B. 49 controller shown in the illustration will give this result. The reverse switch handle may be in either the forward or reverse position, when by moving the main control handle to the braking notches, a rheostatic braking effect will be obtained for either forward or backward motion of the car.

This controller is suitable for use with two 40-H.P., 500-600-volt series motors, and has four series, four parallel and seven-brake controlling points.

Another important new feature of the B. 49 controller is the mechanism by which a defective motor may be cut out of service without removing the cover of the controller. This is a great safeguard in preventing delay in traffic and avoids the necessity for the driver at any time to touch the internal mechanism. To cut out a motor it is only necessary to remove the reverse switch handle from its spindle, and apply it to the cut-out spindle which projects through the cap plate, shown in the illustration near the back edge of the cap plate. This cut-out spindle has three running positions; a central position for which both motors are in circuit, and a position on each side to cut out either motor. An interlocking mechanism prevents the reverse switch being moved unless the cut-out switch spindle is in one of its three running positions. The

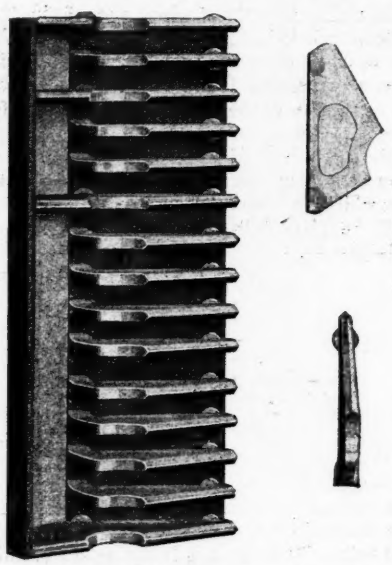


FIG. 3.—DEFLECTOR PLATES, B.T.-H. CONTROLLER.

usual interlocking mechanism is provided to prevent the reverse switch being moved unless the main cylinder is in the "off" position.

The arc deflector of the B. 49 controller, consisting of fire-proof barriers, is of strong mechanical construction, the large deflector plates being supported at both ends, and the small plates moulded with large bosses for the fixing screws, thus providing rigid fixing for the plates. A strong magnetic blow-out is provided for all the fingers of the main cylinder on which arcing takes place, and an insulating trough surrounds the back half of the main cylinder, protecting the frame from the influence of the arc or live parts. The trough is divided into sections by barriers; these, with the arc deflector, which covers the front half of the main cylinder, form separate chambers for enclosing various sections of the cylinder which may be at different potentials.

The brake cylinder is mounted on the main cylinder spindle in accordance with long established standard B.T.-H. practice, thus preventing any possibility of change in the relative positions of brake cylinder and handle, which may occur due to wear on the gears or cams when the brake cylinder is mounted on a separate spindle.

One feature of this controller, not always found on tramway controllers, is the provision of ample space for the incoming cables, and the arrangement of the various parts to enable wiring to be easily and quickly effected.

Key Extractor.

The difficulties often met with in extracting keys, particularly those which have not been provided with a gib-head, are familiar to all engineers, and have wasted many a weary hour, causing vexatious delay frequently at times when economy of time is of the first importance. The inner end of the key is often inaccessible, and then, if the key has no gib-head, the problem is one which taxes the ingenuity of the fitter to the limit; even when the inner end can be got at with a drift, the hammering process is bad for the machine, especially if an electric motor or dynamo is in question, and damage to the key and shaft is often the result.

To avoid all this, MESSRS. FAIRLESS, DIXON & CO, of 36, Bridge Road, Stockton-on-Tees, have introduced a patent key extractor, of which the details are shown in the accompanying figure. A strong forging A is provided with two fine-thread set-screws B and a tapered recess, in which are placed hardened steel dies C; the latter have file-cut faces, and fingers D to catch the gib when there is one. A plate E serves to hold the dies in place. In use, suitable dies are chosen and inserted in the block, which is then laid over the end of the key with the hollow side next the shaft; the screws are tightened against the hub of the pulley or fly-wheel, and the

dies, sliding on the taper faces, grip the key and enable it to be extracted without damage by further tightening of the screws, the operation taking minutes where hours used to be consumed. The

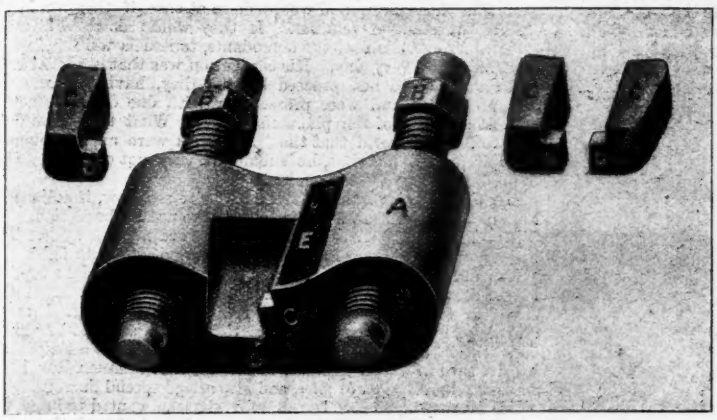


Fig. 4.—Patent Key Extractor.

device is also useful when fitting keys; the key can be driven up tight, extracted and scraped where necessary, until a perfect fit is attained.

"Adams Igranic" Primary Resistance Starter.

The Adams Manufacturing Co., Ltd., of 106, New Bond Street, W., have recently brought out a series of starters suitable for single-phase alternating-current self-starting motors. They are standardised from 1 H.P. to 35 H.P., and are suitable for starting purposes only, not for speed regulation. The rheostat limits the current at starting and prevents line disturbances. The illustration, fig. 5, shows the switch arranged with a detent for maintaining the lever in the "full-on" position, and a hub-spring is provided to ensure the switch returning to the "off" position, as soon as it is released from the detent. Where required a no-volt release can be fitted which protects the motor against a failure of supply.

This form of A.C. starting switch is complete with all the special features used in the "Adams Igranic" starting switches such as ventilated resistance: no soldered joints: no internal connections and porcelain insulation.

E.O.A. Control Pillar.

The accompanying views, figs. 6, 7 and 8, show the "Vickers E.O.A." control pillar, which has been brought out by the Electric and Ordnance Accessories Co., Ltd., of Cheston Road, Aston Birmingham, for the starting and shunt control of D.C. motors in situations where reliability and simplicity in the control gear are

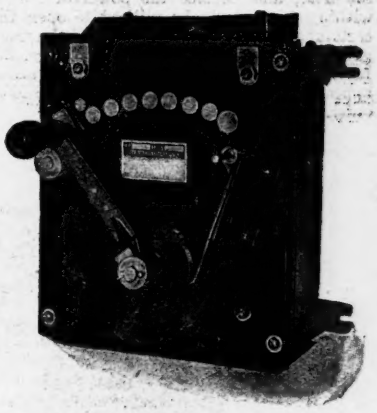


Fig. 5.—Primary Resistance Starter for A.C. Motors.

essential elements. It is claimed that this gear perfectly safeguards the motor under all conditions, is fool-proof, self-contained, and reliable.

The apparatus consists of a D.P. overload and no-voltage circuit-breaker, drum type starter, shunt regulator for variable-speed motors, resistances for starting and regulation, and D.P. switch fuses, all of which are enclosed in a weather-proof case, and operated by a single handle. The pillar is intended especially for the control of motors driving printing presses, calendering machines,

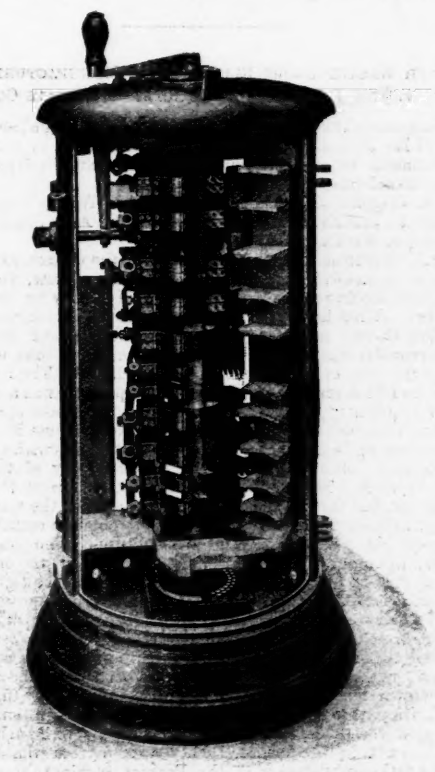


Fig. 6.—Interior E.O.A. Pillar, showing Starting Barrel Blow-Out Coil, and Field Regulator

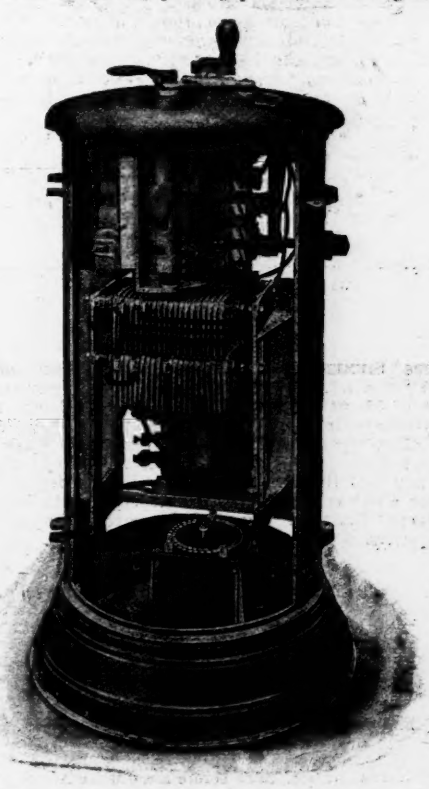


Fig. 7.—Interior of E.O.A. Pillar, showing Starting Resistance, Reversing Barrel and Handle, and Regulator.

machine tools, &c., which have to be frequently stopped and started. Opening the doors while the motor is running, releases the circuit-breaker and stops the motor. A magnetic blow-out is provided, and the sparking tips on the contact fingers can easily be renewed; the starting resistance is rated at one minute. A push-button is provided for stopping the motor instantly at any position of the starting handle, and similar buttons can be fixed on or near the machines controlled. When a reversing barrel is required, this is operated by a separate lever, and is interlocked as usual. Four standard sizes are made, up to 150 H.P. at 460 volts.

"Record" Steam Trap.

A new steam trap is being placed on the market by Messrs. Gillespie & Beales, of Amberley House, Norfolk Street, W.C., which, it is claimed, is quick and positive in action, though simple

in construction, and will work at any pressure from 5 lb. to 200 lb. per sq. in. without adjustment. The special feature of this trap is the provision of a small relay valve, which is easily actuated by the float, and enables the powerful aid of the steam pressure within the trap to be utilised to open the main valve. Thus certainty of action is attained, and the use of a large main valve, giving a rapid and complete discharge, is made possible. The moving parts are simple and easily accessible, and the design appears to be such that the mechanism cannot easily get out of order.

FIG. 8.—NON-REVERSING E.O.A. CONTROL PILLAR, FITTED WITH AMMETER. (See page 871.)

New "Onewatt" Lamp.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, inform us that they are now placing on the market a range of 55-watt "Onewatt" drawn tungsten lamps for high and low-voltage circuits. These lamps will be of the same quality as the other types of "Onewatt" which are at present being supplied, and are specially suitable for street lighting owing to the robust nature of the filament; they may be used for either alternating or direct current. They will be supplied in bulbs of the same size as "Tantalum" lamps of the corresponding voltage and candle-powers.

LEGAL.

"Z" ELECTRIC MANUFACTURING CO., LTD., *v.* OSRAM LAMP WORKS, LTD.

THIS "threats" action came before Mr. Justice Neville on Friday, May 26th, on a motion by the plaintiff company to restrain the defendants, until trial or further order, from threatening users of the "Z" electric lamps with proceedings for alleged infringement of the defendant company's patents.

Mr. T. Terrell, K.C., and Mr. Frost appeared in support of the motion, and the defendants were represented by Mr. Astbury, K.C., Mr. Walter, K.C., and Mr. Colefax.

MR. TERRELL said that he moved for an injunction to restrain threats under Sec. 36 of the Patents Act of 1907, and also at common law. He took a preliminary objection to Mr. Walter appearing for the defendants, because he was under a prior retainer.

MR. WALTER said that question had been raised before, and had already been settled.

MR. ASTBURY said he had a preliminary objection to the motion. There was no offence at common law alleged by the writ, and under the Act the motion could not be made. Sec. 36 of the Act of 1907 provided that any person, claiming to be the patentee of any invention, threatening by circular, advertisement or otherwise, should be liable to an injunction, but the section contained a proviso which ran, "provided always that this section is not to apply if the person making such threats shall commence and prosecute an action with due diligence." The defendants had commenced and were prosecuting with due diligence actions against a considerable number of persons using the plaintiffs' lamps. They wished to sue the plaintiffs themselves, and would do so at once if they would give up this question of retainer. If they would do that he would undertake, on behalf of the defendants, to issue a writ against the plaintiffs that very day. His contention was that a motion under the section could not proceed because they, having commenced, had prosecuted and were prosecuting with due diligence actions against the users of the plaintiffs' lamps. What they were doing was to tell the world that the "Z" lamps were an infringement of their patent, and that, he submitted, they not only had a right to do, but was what they ought to do.

MR. JUSTICE NEVILLE said he did not see how, if actions had been commenced, the plaintiffs could make use of the section.

MR. TERRELL: We say those actions are not *bona fide*. They bring actions against small people who cannot afford to fight.

MR. ASTBURY said the actions were *bona fide*, and he repeated his offer to issue a writ against the plaintiffs that day if they chose to waive the question of retainer. With regard to the second point as to common law, the action was not brought at common law at all. The writ was entirely confined to a claim under the Section. Besides, to maintain an action at common law, it was necessary to allege *mala fides*, and also allege special damage.

His LORDSHIP, to Mr. Terrell, said what he wanted to know first of all was, what were the threats complained of, and then, what evidence he had as to *mala fides*.

MR. TERRELL said his submission was that these actions were not brought for the purpose of trying the question between the parties, but were brought against persons who were not likely to defend them. These lamps were made in Germany from 1905 to 1908, and subsequently in England, and had a very large sale. He read evidence to the effect that since 1906, 750,000 lamps had been sold in this country, which were manufactured under patents of 1900 or 1907, and it was not until the plaintiffs' alleged infringement of those patents that the defendants commenced the threats complained of. He had challenged the defendants to bring an action against them, and they had not done so, and their only excuse was this difference as to a retainer. They had got Sir Alfred Cripps, Mr. Astbury, Mr. Colefax and Mr. Hunter Gray, and now they wanted Mr. Walter. The plaintiffs had a prior claim on Mr. Walter's services.

After hearing the affidavits filed for and against the motion, his LORDSHIP gave judgment without calling upon counsel for the defence. He said he saw no reason for holding that the actions brought against the persons who sold these lamps were not *bona fide* actions, and that defendants could not succeed in any action except against the manufacturers themselves. With regard to the dispute as to the retainer of counsel, it was not for him to interfere. It was suggested that there had been an attempt to obtain the services of a gentleman who he supposed was alleged to be the only competent counsel at the English Bar. He was bound to say, from a very long knowledge of the English Bar, that there was no danger of the plaintiffs not being able to secure a perfectly capable man to conduct their action. The motion would be dismissed, with costs.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., *v.* THE UNDERGROUND ELECTRIC RAILWAYS CO., LTD.

THIS case came before a Divisional Court of the King's Bench, composed of Mr. Justice Pickford and Mr. Justice Lush, on a motion by the claimants to set aside an arbitration award in regard to an alleged breach of contract.

Sir A. Cripps, K.C., Mr. Disturnal and Mr. Tangye were for the appellants; and Mr. J. Roskill, K.C., with Mr. A. B. Shaw and Mr. L. Macassey, for the respondents.

SIR A. CRIPPS said that the question for the Court was of great importance, involving a complicated matter of law, and it was important also in relation to the amount of money involved, some £120,000. What he had to show in order to succeed, was first of all, that there was an error in law on the face of that award, and, secondly, that what had been done upon that matter of law on the face of the award, was in itself bad. The main point which he raised on that, although very important, was a short one The respondents, the Underground Electric Railways Co., of London, gave an order to the British Westinghouse Electric and Manufacturing Co. for the supply of certain turbines with generating machinery in connection with the electrical supply of the Underground system. They supplied the turbines, but were told by the Arbitrator that they were not in accordance with the terms of the contract, the test being that they were to obtain a certain amount of power in relation to the expenditure. The breach had been admitted, and the question was as to how the damages in consequence of that breach of contract should be settled. The question between the parties arose after the turbines were admitted to be bad, so far as the contract was concerned. After they had been running for a time, the Underground Electric Railway Co. substituted Parsons turbines, and the appellants said that the measure of damage, under the circumstances, should be only the additional cost thrown upon them by running the Westinghouse turbines and substituting the Parsons turbines. By the substitution they had mitigated the damage, a matter which ought to have been taken into account in the award. They were agreed that up to the point of the substitution of the Parsons turbines there had been damage; but the appellants said that under the conditions disclosed in the substitution of the Parsons for the Westinghouse, the respondents not only mitigated the damage, but obtained a con-

siderable benefit of the profit for themselves, which ought to have been considered in estimating the measure of damages. When they had got to that stage they asked the Registrar, Mr. Littleton, to state a case for the opinion of the Court. That case was stated and heard before the Divisional Court. For present purposes he would assume that the opinion of the Divisional Court was against him on the point submitted, but the question was how far benefit or profit was to be taken into consideration in estimating the true rate of damage. If their Lordships thought that this Court would be bound by the opinion of the other Divisional Court to which the points were submitted by the Arbitrator's case, then they would have to go the Court of Appeal.

Mr. Justice Pickford said that the Court was of opinion that it ought to follow the decision of the other Divisional Court.

Sir A. Cripps said that the same points would arise as those which were discussed in the Divisional Court over which the Lord Chief Justice presided. If the Arbitrator had followed the judgment, he had not followed the advice given by the Lord Chief Justice.

Mr. Justice Pickford said that what the Arbitrator would have to follow would be the answers to the questions which he had submitted for the opinion of the Court, where they were answered by the judges specifically.

Sir A. Cripps said that the Lord Chief Justice had not answered the questions simply in the affirmative or the negative, because he did not think he would be doing justice to the case by so doing. The first point was whether, as a matter of law, they were entitled to bring to the mind of the Registrar that the true cost was not what had to be paid, but whether they obtained beneficial results. In all cases of damage they came back to the simple test of cost in order to arrive at the true measure of damage. The respondents further contended that they were entitled to recover the cost of the installation of the Parsons machinery. It was almost impossible to answer the question submitted by the Arbitrator with a simple "Yes" or "No," apart from the context of the judgment. What the appellants said was that they must ascertain the actual cost to which the respondents had been put, having in mind that the Parsons machine had a larger scope than the old turbines, and could be worked much more economically. Owing to the march of invention, the Parsons machines were much better than the old ones, and could the Arbitrator award as damages the whole cost of putting in a very much better machine—machines which would work under conditions which would save the respondents £20,000 a year?

Mr. Justice Lush: You say that they are putting a heavy profit into their purse.

Sir A. Cripps said that it was not for the Court to say what the amount of the profit was, but the whole effect of the substitution must be taken into consideration. The Arbitrator was entitled to take into consideration the effect of the Parsons machines, and he said that on that account, mitigation of damages must be brought in. It was a very important point, when they were putting in expensive machinery of that kind. The Arbitrator, in his award, said that he had stated a case on certain points of law, and judgment was given by the Divisional Court on those points, and that judgment formed part of the award. He could not imagine a more important point for discussion in a case of that kind than how to get at the true costs. To get at the true costs, they must have the set-off of the benefit from profit.

Mr. Justice Pickford: You are really asking us to say whether the answers which appear on the record of the Divisional Court are right or wrong.

Sir A. Cripps thought that raised an important point in arbitration law. What he desired to argue was that, in face of the questions, it was impossible to answer them with a simple "Yes" or "No." They were partly questions of fact and partly of law.

Mr. Justice Pickford said he did not see how the Court could deal with the decision of the other Divisional Court.

Sir A. Cripps said that if that were their Lordships' view he would not think it respectful to take up the time of the Court by going into details. The case would have to go to the Court of Appeal. If a summons were taken out to enforce the award, of course the case would stand over pending the appeal.

Mr. Justice Lush said that the Court could only deal with the motion upon the assumption that there had been a mistake on the face of the award. If they could show that the Arbitrator was not understood accurately by the Divisional Court, then they could appeal; but that did not appear to be so in this case.

Mr. Roskill, for the respondents, said that the applicants had abandoned the point that the award was bad on the face of it in so far as it showed that the opinion of the Divisional Court had not been followed.

Sir A. Cripps said that that was not his point.

Mr. Roskill said that the Divisional Court, in giving their opinion, had answered certain questions, and against that he contended there was no appeal. He did not think it right that he should be kept out of the money because the other side wanted time. If it were decided to take the case to the House of Lords, there would be a delay of at least another year.

Mr. Justice Pickford said it would not be nearly so long before the case could be decided by the Court of Appeal. Did the objection mean that the respondents wanted security?

Mr. Roskill: I want much more than that. I want money.

Mr. Justice Pickford: If you want security, I have no doubt it can be given.

Sir A. Cripps: Of the £120,000, our claim against them amounts to £84,000.

Mr. Roskill said that the costs were enormous, the out-of-pocket alone amounting to some £13,000. The question of costs, apart from the question of security, was one which pressed rather hardly upon his clients. He submitted that it was not right that, without some security, they should go on endeavouring to gain time.

Mr. Justice Pickford said that the reasonable thing would be for the appellants to pay the costs under the usual undertaking.

Sir A. Cripps protested that his clients had no sinister motive, and they would give the security.

Mr. Justice Pickford said that the Court could not deal with the case as an appeal from the decision of the Divisional Court.

Mr. Roskill asked that the summons should be dismissed with costs.

Mr. Justice Pickford: We do not deliver any judgment as to whether the Divisional Court was right or wrong, but simply dismiss the summons.

Mr. Roskill: Your Lordships have only heard one side.

Mr. Justice Pickford: We have not heard either side. The summons is dismissed, with costs, and you can settle the matter in the Court of Appeal.

Tramway Accident Claim.

The record has been closed and issues ordered in an action by Annie Fife, 15, Gladstone Terrace, Edinburgh, against the Musselburgh and District Electric Light and Traction Co., Ltd., Musselburgh, for £750 damages for personal injuries. The pursuer states that on the day of the Musselburgh races she and her mother were waiting near Loretto Corner for a car proceeding to Portobello. A large crowd had gathered at the spot, and a car, running at a dangerous speed into the crowd, knocked her down. One of the wheels passed over her right foot, which had to be amputated. There was no provision made, pursuer alleges, for the orderly admission of passengers into the cars, and the accident would not have happened if the defenders' servants had acted with regard for the safety of the crowd. Defenders deny liability and plead contributory negligence. They explain that they made all reasonable and proper arrangements for the safe running of the cars and for meeting the demands of the traffic so far as incumbent upon them. They deny that the car was recklessly driven into the crowd, and state that the driver kept ringing his bell and an inspector kept shouting to the crowd to stand clear. The rush of the crowd, they say, knocked pursuer down, and she, in struggling, stretched her foot across the line in front of the wheel.

Fares by "Special" Tramcars.

An action has been brought in the Court of Session at the instance of the Edinburgh and District Tramways Co., Ltd., against Hope Park, 22, Claremont Crescent, Edinburgh. It appeared that on Saturday, February 25th, 1911, on the occasional of the International Rugby football match at Inverleith, the tramway company ran a special service of cars from the Post Office to Goldenacre, *via* Broughton Street and Canonmills, and charged a special fare of 2d. The distance is 1·48 mile, and the ordinary fare is 1d. The ordinary service was also maintained at the ordinary fare. The defender boarded one of the special cars and travelled to Goldenacre. He declined to pay the special fare of 2d., and tendered 1d. The pursuers state that they are entitled to provide additional special cars, and to demand for these fares in excess of the fares ordinarily charged, but within the authorised limits. They ask declarator of that right, and sue for 1d. The defender states that on April 22nd, 1911, he tendered to the pursuers the 1d. sued for, but that offer was refused, and the 1d. returned to him. On April 28th he again tendered the sum sued for, together with judicial expenses, but the pursuers refused to accept the tender, and persisted in the present proceedings. He is still willing to make payment of the sum sued for. He pleads that the present proceedings are unnecessary, and oppressive. Lord Cullen has closed the record, and sent the case to the roll for discussion.

The National Telephone Co. *v.* The Postmaster-General.

The Railway and Canal Commission, composed of Mr. Justice Lawrence, the Hon. Gaythorne Hardy and Sir James Woodhouse, sitting in the High Courts, on Monday, May 29th, delivered judgment in the above action.

Mr. Justice Lawrence said this case raised important questions under the agreement of February 2nd, 1905, for the purchase by the Postmaster-General of the National Telephone Co.'s system. He detailed the circumstances of the case, and said that Clause 3 of the Agreement gave the Postmaster-General power to exclude from the purchase plant which he considered would be "unsuitable" for the postal service. It became evident at an early stage of the argument that the parties took different views of the meaning of the word "unsuitable"; for the Postmaster-General it was contended that he could object to any plant that he did not want. For the company it was said that the Clause had no such meaning, that it gave power to object only on the ground of the quality or character of the particular plant. At our suggestion this question was argued first. The first thing that struck one upon it was that the word "unsuitable" pointed more aptly to quality than to quantity; next it was surprising that a vendor who had to keep his plant in use in order that it should be sold at all, should agree to leave it in the hands of the purchaser to provide as much other plant as he pleased, which would thus exclude his property from even "Tramway terms." The agreement seemed to protect the Postmaster-General from having any excessive plant imposed upon him, in very clear language—see the provisions as to stores, spare plant, and new exchanges in Sec. 2. It is true that the company was a licensee

only, whose property would be put out of use by the expiration of the licence; but he was a licensee who had performed a great public service, and who was ready to agree to tramway terms. What was now being done in providing new plant and new exchanges to take the place of the company's plant was practically to "scrap" the company's plant in the condemned exchanges. This did not seem to him to be just, and he would require clear words to induce him to hold that such a power was intended to be conferred upon the one party to the agreement by the other. The words did not seem to him to be clear; on the contrary, when all were read and each received its natural meaning, they failed to support the argument. The actual requirements of the service seven years hence may very well apply to the quality and character of the particular plant, and not to the sufficiency of some other and different plant, viz., that of the Postmaster-General to perform the functions of the company's plant. The argument for the Postmaster-General first assumed that "any kind" of plant meant plant of any quality, and not plant of any description or variety. Having made this assumption, it proceeded to treat this as showing that the word "requirements" meant "needs," for "kind" had already dealt with quality. It then said the test of these needs must be what the Postmaster-General would want for the combined business of the Post Office and the company. It thus arrived at the conclusion that any plant of the company could be excluded from the purchase if the Postmaster-General had become possessed of other plant of a similar description sufficient to serve the purpose. So that however necessary the plant objected to might have been to the service of the company, however high its quality and modern its type, the Postmaster-General could reject it. This seemed to him a not very wise or very likely bargain for even a licensee to make, seven years before the expiration of his licence; but laying that consideration aside, it was not construction at all. When individual words might have two or more meanings, one must not begin by assuming one meaning because it happens to suit one, and disregard all others. Further, one must not treat as pedantic and technical a reference to the exact meaning of other words in the sentence merely because they render one's assumption impossible. This was what the argument did; it said the "actual requirements of the telephone service of the Post Office on December 31st, 1911," meant the prospective needs of the combined business of the company and the Post Office on the following day. No reason was vouchsafed why this transposition should be made, but allusions to the public purse and the propriety of economy were gracefully substituted. With this provision the words of Sec. 9 (1) of the London Agreement should be compared; there the date taken was "after" the determination of the licence, not before; even then he did not think that any idea of excluding duplicate or surplus plant was visible, but there was in the section now in dispute a clear change of language, and this should in itself have some intention attributed to it unless this could be clearly negatived by reference to other parts of the agreement. It was clear that when the parties to the agreement had in mind any question of a surplus quantity, they knew how to express their intentions in the plainest language—See Sec. 2 (1) (D) as to stores, and (2) as to spare parts. The next matter for consideration was the alleged invalidity of the notices of objection served upon the company by the Postmaster-General. It was urged for the company that these notices were wholly bad on the ground of vagueness and generality, and the Commissioners were asked to amend the prayer of the application by deleting the words of exception therein contained. He thought it would be improper to make this amendment, both upon the general principles applicable to the amendment of pleadings, and also because he thought that the exception in question was well founded. The notices were not wholly bad. There was no prescribed form of notice, and a notice was only bad upon the face of it when it failed to perform the functions for which it was required by the statute or agreement. The purpose which a notice was in this agreement designed to serve, was to inform the company that the Postmaster-General considered certain property unsuitable, and that he proposed to exclude it from the purchase. The mere notice effected its exclusion, unless the company within six months obtained an award that it was suitable. That the property which it was proposed to exclude should be identified by the notice seemed to him to follow from the fact that it was a part which it suggested should be excluded from the whole, and this was supported by the language used in Clauses 3 (1) and 3 (2). It was "such plant," &c., "as he considers will be unsuitable," and the award was to deal with that which had been "specified" in the notice of objection. The London Notice, Part I. seemed to him to comply with these requirements, though it might be that before settling the question of fact as to whether the property mentioned therein was or was not suitable, some further particulars might be necessary. The same thing was true of the Abergavenny Notice and of other notices; but when he turned to Part II of the London Notice, in so far as it purported to apply to plant other than that included in Part I, it seemed to him to be bad; it did not give one any idea of what plant it was or where it was situate, except that it was in the London area. What it did was to give grounds of objection without stating the property to which they were alleged to apply. It was one thing to specify a piece of property to which one objected, and another to specify a quality to which one objected. Whether any particular piece of property was open to one or more of these grounds of objection was a matter about which opinions differed, and until the property was identified the question could neither be considered nor determined. The notice relating to non-competitive areas was bad for these reasons. It was no answer to say that it would have been difficult and troublesome to give a notice mentioning the plant objected to. The difficulty of duly exercising a power was no excuse for not doing so if the rights of other parties were affected thereby Here the company disputed that any of its property was open to these defects. This form of notice would exclude it all from the purchase, unless and until the company proved to the Court that each particular part had not the defect. This was to change the onus in a manner not justified by anything in the agreement, and to read "such plant as he considers unsuitable" as satisfied by a notice which was so framed because he did not know the facts, and did not desire the trouble of considering them—this, although the Postmaster-General had the right under the agreement to make the company furnish him with all the information he might reasonably require.

The HON. GAYTHORNE HARDY concurred in his Lordship's judgment.

SIR JAMES WOODHOUSE also delivered judgment, and said that two preliminary questions of great importance were raised by this application. The first question was whether the notices, which had been given by the Postmaster-General under the agreement of purchase between him and the company, whereby he objected to take over from the company certain plant and buildings belonging to them, were in whole or in part invalid. The other question involved the determination of what plant, land and buildings the Postmaster-General was entitled to exclude from the purchase. He reviewed the history of the undertaking, and said that the company had in the London area 63 exchanges; 12 of these were in the Metropolis, and 51 in the suburbs. Of the 12 in the Metropolis, the Postmaster-General objected to three, viz., the Avenue Exchange in Lime Street, the Bank Exchange in Queen Victoria Street, and the Westminster Exchange in Northumberland Avenue, and of the 51 outside he objected to 18. In form the notice was that the Postmaster-General "considers that the plant, land and buildings described in the schedule hereto, and now in use for the purposes of the said company's licensed telephonic business in the competitive area of London, will be unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911, and that the Postmaster-General objects to buy such and so much of the said plant, land and buildings as is so in use on January 1st, 1911." The notice raised, and was obviously intended to raise, the Postmaster-General's claim to reject as unsuitable for his service the entire exchanges and all the equipment—such as switchboards, apparatus, and all wires connecting the subscribers with the Exchange, or the Exchange with any other exchange. Whatever judgment they might come to after investigating on their merits the subject matter of this notice, he could see no ground for saying that the notice itself was vague or indefinite. He thought it would have been difficult to make it more specific, and he was of opinion it was sufficient for the purpose intended, and that it was not invalid. It was then argued that the notice was separable, and though it might be held sufficient as to Part I of the schedule, it was ineffective and void as regards Part II. Part II related to all plant other than what was referred to in Part I. The first paragraph was typical of the remainder. The Postmaster-General objected to take "all telegraphic lines connecting any exchange with any subscriber's office or call office or other exchange and not consisting of or forming a complete metallic circuit." As he understood the argument, the notice as to this was bad in form, because its language was generic instead of specific. It did not, it was said, bring home to the mind of the company's officials, as a proper notice should do, what it was the Postmaster-General desired to exclude with sufficient definiteness to enable them to determine whether to acquiesce in it or to dispute it. It should, it was argued have stated how many lines and what they were. With great deference he was unable to accept this view. Every telegraphic engineer knew what a metallic circuit was, and what lines under his control constituted a metallic circuit. The company's engineer could identify at once the lines which came within this description, and what precisely the Postmaster-General was objecting to take. The facts as to what particular lines did not conform to the requirement in the specification, and were within the objection of the Postmaster-General, were in the knowledge of the company. As for the remaining paragraphs of the schedule, his view as to the first item applied also to them. The next point dealt with the plant, &c., which the Postmaster-General might exclude from the sale. By Clause 3 he might object to buy such plant, land or buildings as he considered unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911. This clause qualified Clause 2 and limited the Postmaster-General's obligations. It was contended for the company that "unsuitable" here referred solely to the character or kind of plant, and not in any sense to the quantity of the plant that might be rejected. If the word "unsuitable" stood alone, he would find it less difficult to accept the narrower interpretation; but when taken in collocation with the words which followed, he thought it had, and according to the scheme of the Agreement was intended to have, a quantitative as well as a qualitative meaning. The test appeared to him to be the Postmaster-General's needs. He saw no inconsistency in reading unsuitability for the Postmaster-General's requirements as applying differently in Sub-Clause (*a*) from Sub-Clause (*b*), as the circumstances of its application were different. "Suitable" was defined by the "Imperial Dictionary" as meaning not only fitting but "adequate." Adequacy was a quantitative expression, and the moment it appeared that this meaning could be assigned to the word, he thought, taken in conjuction with the remaining words, they were precluded from restricting it within the limits contended for by the company's counsel. With the utmost respect for the different view taken by his colleagues, he thought on both the questions submitted for their determination the Postmaster-General was entitled to judgment.

The ATTORNEY-GENERAL (Sir Rufus Isaacs, K.C.), for the Postmaster-General, intimated to the Court that the case would go to the Court of Appeal.

CONNOLLY BROS., LTD.

IN the Chancery Division, on Tuesday, May 30th, Mr. Sargent, for the plaintiff, moved for judgment in default of defence in the case of Wood against Connolly Bros., Ltd., cable manufacturers, Manchester. The plaintiff was a debenture-holder, and in giving the usual judgment in a debenture-holder's action, his LORDSHIP directed a special inquiry as to priority of encumbrances.

GLASGOW TRAMWAYS ASSESSMENT APPEAL.

SHERIFF PRINCIPAL GARDNER MILLER has issued judgment in an appeal by the Glasgow Corporation Tramways Committee against the City Assessor in reference to the assessment of tramways. The Tramways Committee maintained that the tramways were a railway, and should, like railways, be assessed only on one-fourth of their value as entered on the Valuation Roll, while the City Assessor, on the other hand, maintained that the tramways were not a railway, and that except in those statutes where tramways are specially mentioned as entitled to the reduced assessment, they are liable, like ordinary heritages, to be taxed on their full value. In dismissing the action and deciding in favour of the City Assessor, the Sheriff Principal states that: "It is plain that a railway company, in so far as the road upon which their line is laid is concerned, get less benefit from the rate applied to such matters as police, lighting, maintenance of roads, &c., than other classes of heritage, and, accordingly, they are only assessed at one-fourth of their yearly valuation for these purposes. But it is difficult to see why a tramway line does not get the same benefit as other heritages from the expenditure of the rates upon lighting, police, maintenance of roads, and even sewage. If they do get the benefits like any other heritages from the expenditure of the rates, there is no reason why the Legislature should have granted a particular exemption in their favour as compared with other ratepayers in the district. After fully considering these arguments, he was inclined to hold, apart from authority, that the words in the statute, 'the line of any railway constructed under the powers of an Act of Parliament for public conveyance,' did not apply to the case of a tramway, and, therefore, the appellants in this case had failed. With reference to authorities on this question, the Sheriff proceeds to say that there is no decision directly bearing on the application of assessment of tramways in Scotland, although two authorities having an indirect bearing were referred to. In England the question had been directly raised, and it had been decided that a tramway was not a railway within the meaning of the clause of exemption in the rating statutes. Upon the whole matter, the Sheriff feels bound to follow the authority of the decisions of the Courts of England. As the question is a novel one in Scotland, and the decision will upset a practice which has continued for many years, he finds neither party liable in expenses.

ELECTRIC LAMP CONTRACT.

LORDS JUSTICES VAUGHAN WILLIAMS, Fletcher Moulton and Farwell, in the Court of Appeal, on Tuesday, May 30th, heard the appeal of the plaintiffs in the action of the United Lighting and Maintenance Co., Ltd., *v.* Leisegang, from an order of Mr. Justice Ridley in reference to the service of a writ out of jurisdiction. The Judge in the Court below made an order setting aside a writ served out of jurisdiction for which leave had been granted by Mr. Justice Bucknill. On an *ex-parte* application in Chambers, the action in which the point arose was in relation to a supply by the defendant firm, who carried on business at Magdeburg, of 50,000 electric light lamps to be delivered in London. Their Lordships held that the contract being to deliver in London, it was, in fact, a London contract, and there was sufficient to bring the case within the terms of Order 11, Rule 1.

Their Lordships allowed the appeal, and affirmed the order of Mr. Justice Bucknill.

DEATH FROM ELECTRIC SHOCK.*

ANY rational method of resuscitating patients nominally killed by electric shock must be based on a clear conception of the physiological effect of such shocks. There is considerable variation in the susceptibility of different animals to electric currents, particularly as regards the effect of the latter on the heart. The results obtained by careful experiments on animals are, therefore, not entirely applicable to man, and we are forced to reason largely from the more or less indeterminate conditions and results of accidental shocks.

The chief causes of death from electric shock are undoubtedly "fibrillary" contractions of the heart and respiratory paralysis. By the former are meant incoordinate contractions of the individual muscles of the heart, resulting in complete derangement of its normal rhythmic beat. Respiratory paralysis seems to be identical with the results of an overdose of an anæsthetic. Respiration may continue, and consciousness be preserved, in cases of fibrillary contractions, till anæmia of the nervous system causes death, but, if the action of the heart be unimpaired, respiration can frequently be artificially restored. As yet there is no known reliable means of restoring the normal action of the heart once it is deranged; on the other hand, if the respiratory organs are alone affected, prolonged artificial respiration enables a considerable percentage of recoveries from apparent death.

The manual system of artificial respiration requires considerable skill in application, and, at the best, effects a very limited exchange of air. Drs. Stanton and Krida, therefore, recommend the provision of a small hand or foot bellows in all places where shock accidents are liable to occur. A suitably curved metal or hard-rubber discharge tube must be passed from the bellows into the larynx, and some person, always at hand, should be trained to perform this operation. The bellows must then be worked rhythmically and should give an injection pressure of about 8 mm. mercury. During expiration, the bellows pressure must be released, but *no artificial suction must be applied*, or the smaller lung passages will collapse and prevent the total ejection of the air. Till the bellows are set to work, the ordinary manual system of respiration should be employed. The patient should be placed head downwards at 35° to the horizontal.

The conflicting results reached by many investigators, as to the physiological effects of electric currents, are chiefly attributable to the different forms of current employed and the diverse experimental conditions. The following remarks apply to cases of shock from circuits carrying amounts of energy such as are used in ordinary commercial work. The current passing through the body of the victim probably varies between ½ and 10 or more amperes.

According to Drs. Stanton and Krida, the effects produced by direct and alternating currents vary directly with the current strength (and hence with the applied voltage), with the duration of contact and with the path of current flow through the body. The frequency of alternating currents is of great importance, low-frequency currents being usually more dangerous than high-frequency currents of the same strength.

Paralysis of the heart is especially liable to result from low-pressure currents, particularly if the heart be in the path of current flow: respiratory paralysis, however, usually follows on anæsthesia of the central nervous system set up by high-pressure currents. Actual destruction of tissues by burning occurs only at the site of high-resistance contacts, and is of minor importance as a cause of death; nevertheless the tissues often slough far beyond the apparent limits of the burn. In cases of accidental shock, the body often serves merely to complete the path of a high-pressure arc.

In general the lower animals are more susceptible than human beings to electric shock. Whereas 70 volts D.C. is often fatal to dogs, 100 volts scarcely affects a normal man, 200-400 volts produces muscular cramp, and 550 volts produces almost instantaneous respiratory failure.* Low-pressure A.C. shocks are liable to cause fibrillary contractions; 600 volts causes fibrillations and respiratory paralysis, but 2,300-4,800 volts usually affects respiration alone (in such cases artificial respiration should be persevered with, for hours if necessary). The medical reports of the U.S.A. electrocutions since 1890 show that a few seconds flow of 2 to 7 amperes (at 1,500 volts, 15 to 50 cycles per sec.) may not cause death, but with an application of 45 to 50 seconds' duration, the heart's action is permanently suspended.

Train Lighting.—In the course of a long article in the *Génie Civil* on the lighting of railway trains, data derived from the experience of the French companies with various systems are given; the unit is in each case the lamp-hour, the candle-power per lamp being for oil 7 C.P., for gas 20 C.P., and for electricity a minimum of 25 C.P. Equal lighting hours are assumed in each case, and the cost of oil is taken as 7½d. per kilogramme; the price of gas is given as 4s. 3d. to 5s. 2d. per 1,000 cb. ft., including compression, and the cost of fuel per H.P.-hour at the axle is taken to be ½d., the dynamo being driven from the axle of the vehicle.

The results are summarised below:—

Lighting agent.	Oil.	Gas.	Electricity.
Cost of energy for lighting ...	0·202d.	0·049d.	0·016d.
Labour	0·119d.	0·033d.	0·021d.
Repairs and maintenance ...	0·056d.	0·037d.	0·058d.
Interest and depreciation at 5 per cent.	—	0·100d.	0·080d.
Cost of fuel for extra haulage...	—	0·029d.	0·019d.
	0·377d.	0·248d.	0·194d.

It will be seen that electric lighting is much cheaper than either of its rivals, while it gives 25 per cent. more light than gas, and three and a half times as much as oil; the price of gas may be criticised as higher than generally obtains in this country, but even if this is cut down to one-third, the cost of gas lighting remains in excess of that of electricity. In view of these figures, and the freedom of electricity from the fire risks associated with oil and gas lighting, the speedy adoption of electric lighting in place of oil, and its gradual substitution for gas lighting as the plant for the latter becomes worn out, are recommended.

* "New York State Journal of Medicine," September, 1910; Stanton & Krida: also, "Archives of the Röntgen Ray," 1911, pages 896-99.

* Other authorities, notably Mr. Trotter, report much less serious results from 500-volt shocks.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"INQUIRER" writes:—"In an article which appeared in the ELECTRICAL REVIEW some time ago dealing with the law of contracts, a case was cited in which a contract was decided to be void in consequence of its having been assigned to a third party, although there was nothing in the contract to show that it was not assignable. The position taken up by the firm who gave the contract in the first place was that they had especial confidence in the firm to which they gave it, and that confidence was not transferable at the option of the contractor.

"I have searched back numbers and looked up the index for the last two volumes, but cannot come across the article, and should, therefore, be exceedingly obliged if you would refer me to the number containing same, as it may prove very useful to me at the present moment."

*** It has not been found possible to identify the article containing the reference to which "Inquirer" refers. The principle, however, which arises in relation to the employment of sub-contractors, is well known to those who are familiar with the law of contract. It is thus stated in "The Law Affecting Engineers" (Constable & Co.): "Generally speaking, where there is no stipulation against sub-contracting, a contractor may employ sub-contractors. The rule, however, is subject to the qualification that it does not apply when the employer reasonably and naturally looks for the personal service and attention of the contractor. Thus, if the work in hand were of a highly special character, it would not be competent for a contractor, who was skilled in the class of work, to hand over its performance to someone else." The case usually referred to in support of this proposition is one cited by Patterson, J., in Wentworth *v.* Cock, 10 A. and E. 45, where it was held that a contract to build a lighthouse could not be assigned. It is probable that "Inquirer" will find his case covered by a clause in an agreement to the effect that the builder "shall not, unless with the written consent of the employer, employ a sub-contractor for the execution of the works or any part thereof; but shall personally superintend the same."

BUSINESS NOTES.

Westinghouse Electrical Plant Contracts.—We are informed that among the important orders received by the BRITISH WESTINGHOUSE Co. are the following:—

Underground Electric Railway.—One 1,200-KW. rotary transformer and switchgear.
Metropolitan Railway.—One 1,000-KW. rotary converter.
Borough of Poplar.—Three 250-KW. rotary converters and switchgear.
Cardiff Corporation.—One 700-KW. rotary converter and transformer.
Stoke-on-Trent.—Three 600 and two 300-KW. rotary converters.
Glasgow Iron and Steel Co.—One rotary converter 40-KW., one 47 K.V.A. transformer and control gear.
C. W. Fairweather.—Two 250-H.P. A.C. motors, one 37, one 35 H.P. squirrel-cage motors, two starters, switchboard and two 625-K.V.A. transformers.
Staveley Coal and Iron Co.—Six 27, six 10, two 40 and four 20-H.P. motors and three polyphase relays.
Fife Coal Co., for Lindsay Pit.—Four 50-H.P. 3,000-volt 575 R.P.M. three-phase 50-periods 283 P.B. motors, controllers and resistances.
E.E.S. Co.—Four 600 and 400 K.V.A. transformers.
Cleveland and Durham E.P.—Two 600-K.V.A. transformers.
Prestwich County Asylum.—One booster set consisting of two boosters and one motor and starter; one balancer set consisting of two balancers, two rheostats and starter.
Rennert & Lens.—One 400-KW. alternator.
Kuishin Tanko Kisen K. Haisha (Takata & Co.).—Two 500-KW. three-phase 60-period 3,500-volt 3,800 R.P.M. turbo-alternator sets, two surface-condenser air pumps, motors, transformers, &c.
Greenock Corporation.—Sub-station switchgear.
Earl's Court Exhibition.—4,500 illumination holders, rubber sleeves.
Oldham Corporation Tramways.—Supply and erection of 12 sets of magnetic brakes with skid-proof attachments.
Aberdeen Corporation.—Sub-station switchgear.

Private Meetings.—ARTHUR JOPLING, trading as Arthur Jopling & Co., 10, Westmorland Buildings, Aldersgate St., E.C., electrical engineer.—A meeting of the creditors was held on Tuesday, last week, at the offices of Mr. G. W. Davey, solicitor, 16, John Street, Bedford Row, W.C., when a statement of affairs was presented which had been prepared by Messrs. Corfield & Cripwell, accountants, of Finsbury Pavement, E.C. This disclosed liabilities of £1,602, of which £367 was due to trade creditors and £1,235 to cash creditors. After allowing £5 16s. 8d. for preference claims, the assets were estimated to realise £385, or a deficiency of £1,217. It was reported that the debtor's wife was a cash creditor for £400, money advanced prior to her marriage. The debtor's father had advanced sums aggregating £1,800, but £1,000 had been regarded as a gift, and he was only scheduled as a creditor for £800. A brother of the debtor's was a cash creditor for £35. The business was commenced on March 29th, 1909. At that time the debtor had practically no capital of his own, and he had all along relied upon periodical loans from his father. The debtor had specialised in the manufacture of arc lamps, and in that direction he had sustained a rather heavy loss. He had also done a factoring business in electrical appliances. Neither the turnover nor the profit made had been sufficient for the expenses of the business. The sales ledger showed that during the 12 months ended March, 1910, the sales were £1,022, while during the past year they aggregated £1,173. A gross profit of about 20 per cent. was made, but against that the weekly expenses were about £11. The drawings of the debtor had been £3 10s. a week, he had paid a manager £3 5s. a week, and had employed two travellers at 30s. a week each. It appeared that he had been losing money during the whole of the time he had been trading. The loss on the trading had amounted to £1,385, while there had been other trading losses, principally in connection with a branch at Leeds, of £450. Proceedings had been commenced against the debtor by two or three creditors, while one firm was in possession. The solicitor stated that he thought the father would withdraw his claim, and on behalf of the debtor he made an offer of 6s. 8d. in the £, payable as to 5s. in cash, and 1s. 8d. in a month. The debtor was called into the room, and in answer to questions said he did not think he could profitably continue the business. He believed that his wife would be prepared to withdraw her claim until the trade creditors had received 10s. in the £. After a lengthy discussion, it was decided to accept a composition of 10s. in the £, payable as to 5s. in cash, and the balance at a later date. It was also resolved that an assignment should be made to Mr. Corfield, and a committee of three of the principal creditors was elected.

The following are creditors:

General Accessories Co., Ltd., London	£17
ELECTRICAL REVIEW, London	21
Electricity, London	31
Grevener, J. & H., London	25
Turner & Co., London	111
Young, James, South Shields	47

COWANS, LTD., Springfield Lane, Salford, Manchester, electrical engineers.—The shareholders of the above having passed a resolution in favour of voluntary liquidation, a meeting of the creditors interested was held last week, when a statement was presented showing the position as at February 27th last. This showed ranking liabilities of £10,168, of which £3,150 was due to trade creditors, and £632 to unsecured cash creditors. There were first debentures in existence for £3,018, and second debentures for £3,023. There were also partly secured cash creditors for £645, of which £345 was expected to rank. The assets on paper appeared at £22,958, but they were only estimated to realise £4,454. From the latter figure had to be deducted £406, owing to preferred creditors, and the net assets were thus reduced to £4,048. The assets were as follows:—Plant and machinery, £2,132; expected to produce £700; portable tools, £1,288, valued at £400; furniture and fixtures, £984, estimated to realise £125; instruments, £302, expected to produce £125; stock in trade, £1,053, valued at £600; work in progress, £1,608, valued at £1,120; cash in hand, £34; book debts, £1,422, expected to produce £1,300; and investment in engineering company, £50. It was stated that the issued capital of the company was £14,520, while there was an amount to the debit of the profit and loss account of £3,043. In the books of the company the depreciation fund stood at £1,206. The gross liabilities were £22,958, and the deficiency of £18,910 could be fully accounted for. The principal items in the deficiency account were:—Written off patents and goodwill, £1,081; furniture and fittings, £858; portable tools, £887; plant and machinery, £1,431; buildings, £111; Switchgear Co., £3,509; work in progress, £487; and stock in trade, £452. Mr. Colin Cooper, of 33, Princess Street, Manchester, reported that he was appointed as Receiver for the first debenture-holders on February 27th last, and that appointment was subsequently confirmed by the Court. At a later date he was also appointed Receiver for the second debenture-holders, while on May 1st the shareholders nominated him as the voluntary liquidator of the company. The first debentures for £3,000 were issued in February, 1902, and formed part of an authorised issue of £5,000, the remaining £2,000 being issued to the bank to guarantee an overdraft. In June, 1908, the company entered into an agreement to purchase for £3,000 certain plant, machinery, and book debts from a concern known as the Switchgear Co., manufacturers of electrical goods, and a second debenture was given in this connection. The company was formed in May, 1898, with a nominal capital of £30,000. During the year ended December, 1907, the company made a profit of £816, while during the following 12 months there was a profit of £629. During 1909 there was a loss of nearly £1,000, while during the past 12 months there had been a loss of close upon £800. According to the articles of association the consent of the preference shareholders had to be obtained before any debentures were issued. It appeared that their consent was not obtained to the issue of the second debenture, and the liquidator was taking counsel's opinion with a view of ascertaining whether it was a charge upon the assets. A creditor remarked that even if the second debenture was not valid it did not appear as if there would be a great deal to come to the unsecured creditors after the first debenture had been paid off. In answer to a question the liquidator stated that efforts had been, and were still being, made to dispose of the business as a going concern. No resolutions were passed, and therefore the voluntary liquidation of the company remains in the hands of Mr. Cooper. An informal committee was appointed consisting of Messrs. Thomas Bolton & Son, Ltd., Messrs. Everett, Edgcumbe & Co., Ltd., and Mr. A. Cripwell.

Irish Contracts.—Replying to a question in Parliament by Mr. Brady, Mr. Birrell says the Irish Agricultural Department have not yet invited estimates from Irish or any other firms for laboratory apparatus, &c., for the new College of Science, Dublin. An order for electrical works for experimental purposes has been placed with a London firm who are carrying out the electric lighting of the new college. Replying to a further question, Mr. Birrell says he has little doubt there are firms in Dublin capable of supplying electrical apparatus to any public body.

Manufacturing in Russia.—The report of the Russian Siemens & Halske Co., of St. Petersburg, states that the economic development which started in the first half of 1910 brought about an increase in the orders received by the company in the heavy electrical engineering department. It arose almost exclusively from private industry which commenced to undertake improvements and extensions of the technical equipment which had long been postponed. Prices remained low not only because the rivalry of inland firms continued extremely keen, but also because foreign firms participated in the competition under conditions which were difficult of comprehension having regard to the import duties, &c. In the case of the light electrical engineering department, there was frequently a lack of orders, as the Government contracts were restricted to the lowest limits also in the past year. The company, which was working in conjunction with the Berlin Telefunken Co. in the matter of wireless telegraphy, established stations at Petropawlowsk and Nikolajewsk. This installation was noteworthy from the fact that it opened the Kamtchatka to telegraphic traffic, and placed this form of the transmission of news for the first time in Russia at the service of the public. The accounts and balance forward show a surplus of £41,313 for 1910, as compared with £38,921 in 1909, and a dividend of 5 per cent. has been declared, being the same rate as in the preceding year. A second Russian company is the United Cable Works Co., of St. Petersburg, whose share capital is held in equal parts by the Felten and Guilleaume Co., of Frankfort, the A.E.G., of Berlin, and the Siemens & Halske Co., of Berlin. Including the balance forward, the net profits realised by the cable company amounted to £76,143 in 1910, as contrasted with £64,359 in the preceding year. A dividend at the rate of 8 per cent. has been declared, as against 7 per cent. in 1909.

New German Works.—According to a communication made by the Association for Municipal Affairs of Bitterfeld, the Siemens-Schuckert Works Co. proposes to erect large works at Flur-Niemegk, where employment would be provided for from 3,000 to 4,000 workers. The company is said to be in negotiation with the State Forest Authorities in regard to the purchase of Goitzsche forest for the sum of £400,000, it being intended to work the coal deposits there.

Dissolutions and Liquidations.—LAMBIE, WRIGLEY AND Co., 116, City Road, London, E.C.—This partnership has been dissolved as from May 27th. Debts will be attended to forthwith and the business of electrical contractors will be continued as heretofore under the title of J. Lambie & Co.

BROCKIE-PELL ARC LAMPS, LTD.—A meeting is to be held at 10, Wallbrook, E.C., on June 26th, to hear an account of the winding up from the liquidators (Messrs. R. Warner, Duncan Watson and H. McLellan).

THORNTON & CREBBIN, LTD.—A meeting is to be held at 62, Market Street, Bradford, on June 29th, to hear an account of the winding up from the liquidators.

"THE ELECTRIC AND AUTOMATIC ENGINEERING CO." and "THE NEW ENTERPRISE CO.," Engineers and Advertising Display Specialists, Chatham.—Messrs. W. T. Wright and J. Miller have dissolved partnership. Mr. Wright attends to debts.

Bankruptcy Proceedings.—JOHN DENNIS CARLMARK, electrical engineer, 402, High Street, West Bromwich, Stafford.—The first meeting of creditors herein was held on Friday last at 191, Corporation Street, Birmingham. The liabilities amounted to £440, and the assets were estimated to produce £49, thus disclosing a deficiency of £391. The debtor attributed his failure to keen competition, bad trade, and making himself liable for £200 as guarantor on behalf of his brother-in-law. It appeared that the debtor started business in 1899 in partnership with another, the debtor having at that time no capital. No balance-sheets or profit and loss accounts had been prepared beyond rough estimates, which were not retained. In May, 1910, the partnership was dissolved, the firm then being on the wrong side to the extent of about £280. The debtor also had private liabilities amounting to about £80. On retiring the debtor's partner received £35 for his interest in the business. The partners had drawn at the rate of £175 to £200 a year each. The debtor had since traded on his own, and had paid off most of the firm's liabilities, but had contracted others, which were now owing. The matter was left in the hands of the Official Receiver.

A. C. A. WAMPACH, electrical engineer, Hythe.—June 10th is the last day for the receipt of proofs for intended dividend by J. O. Morris, 68A, Castle Street, Canterbury.

Catalogues and Lists.—MESSRS. HILL & HARRINGTON, LTD., 76A, Great Portland Street, Oxford Circus, London, W.—Eight-page illustrated list, giving particulars of their "Diamond" letters for electric sign purposes. The faces of the letters are at an angle of 45° to the building upon which they are attached. The outer case is made of enamelled metal and opal glass, and the electric lamps are within, under cover. An effective and bold appearance is claimed. Any colour effect can be obtained by using coloured lamps or else by substituting coloured glass for the letter faces. Prices are quoted in the list, and details for fixings for the letters are also given.

MESSRS. W. GEIPEL & CO., 72A, St. Thomas Street, London, S.E.—16-page illustrated price list of Henrion carbons for arc lamps, flame lamps, cinematographs, projectors and welding.

THE HART MANUFACTURING CO., 77, Rochester Row, Westminster, S.W.—New catalogue of 32 pages just issued, giving particulars very fully illustrated with half-tones and with wiring diagrams of the various styles of "Diamond H" switches—push button, automatic door, rotary flush, surface, tramcar lighting—combination plates, and other specialities of this well-known class.

MESSRS. CROMPTON & CO., LTD.—New eight-page pamphlet (D 31) containing a brief illustrated description of the C.M.B. auto-convertor. The half-tone views show the equipment in position at the South Kenmuir Colliery, near Glasgow. Prices are tabulated.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—24-page catalogue of "Freezor" electric fans, containing a centre supplementary section illustrating and describing various additional fan features for the present season. Among these features is the "Vane" type oscillating pattern of fan for desk use, for which there is a greatly increased demand. The "Lite-weight" ceiling and bracket fans, the "Malvarma" ceiling fan, and the oscillating pattern ceiling fan, call for special reference. Increased demand and enlarged outputs have decreased prices, the reductions in some cases being substantial, as indicated by a special slip at the front of the catalogue. For the use of contractors and others a large supply of attractive advertisement folders are now available, and they can be printed with any desired name and address.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street, Dalston, N.E.—Leaflet No. 10, clearly tabulating prices and sizes of auto-transformers for tantalum, "Onewatt," and other low voltage metal-filament lamps, also balancing auto-transformers, double-wound transformers specially suitable for Stannos concentric wiring, and bell transformers. The firm will also supply other types not included in the list. Copies of the circular will be sent to anyone interested.

THE ADNIL ELECTRIC CO., LTD., London, E.C.—Leaflet relating to "Soar's" disinfectant telephone transmitter.

Book Notices.—The *Journal* of the Tramways and Light Railways Association for June contains copies of the Board of Trade Regulations regarding guard wires; the Home Office Report regarding street accidents caused by vehicles; and details relating to the Association's Congress to be held at Edinburgh in July.

The Engineering Standards Committee has issued a circular drawing attention to Report No. 52, the British Standard Specification for Bayonet-Socket Lampholders and Caps, and to the fact that the Specification for Steel Conduits for Electrical Wiring (Report No. 31) was revised in September last. Either can be obtained from the offices of the Committee, 28, Victoria Street, S.W., post free for 5s. 2d.

"*Bulletin* of the Imperial Institute," Vol. IX, No. 1. 1911. London: Eyre & Spottiswoode, Ltd. Price 1s. net.

"*Journal* of the Western Society of Engineers," Vol. XVI, No. 4. April, 1911. Chicago: The Society. Price 50 cents.

"Report of the Council of the City and Guilds of London Institute." 1911. London: Gresham College.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders," Vol. XXVII, Parts 4 and 5. May, 1911. London: Andrew Reid & Co.

"Il Nuovo Cimento." March, 1911. Pisa: Tipografico Toscano.

"*Bulletin* of the Association des Ingénieurs." May 1, 1911. Liege: Rue St. Gilles. Price 5 fr.

"Whittaker's Electrical Engineer's Pocket-Book." By Kenelm Edgcumbe. 1911. London: Whittaker & Co. Price 5s. net.

Trade Announcements.—MESSRS. W. T. GLOVER and Co., LTD., of Trafford Park, announce that Mr. McEwan, who has represented them in the East of Scotland, has now been appointed sole resident representative for the whole of Scotland, Mr. Scott, of Glasgow, who has represented them for many years, having resigned. The firm will carry large stocks of rubber insulated cables at the following addresses:—Glasgow, 196, St. St. Vincent Street ("Conductors, Glasgow," "National, 956 Argyle," "P O, 1,174 Central"); Edinburgh, 9 Clyde Street ("Conductors, Glasgow," 6,848 Central").

MESSRS. R. N. CUNNINGHAM & CO., electrical engineers and contractors, of 171, Edgware Road, W., are opening additional showrooms at Bayswater Road, Notting Hill Gate, W., and they invite makers of fittings to send catalogues, &c.

Holidays.—The INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., of Silvertown, London, E., announce that their works will be closed from Saturday mid-day, June 3rd, until Tuesday morning, June 6th, and from Wednesday evening, June 21st, until Monday morning, June 26th.

The works and offices of the ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., will be closed for the Whitsuntide holidays from to-night, June 2nd, to Wednesday morning, June 7th; and for the Coronation, from Wednesday evening, June 21st, to Friday morning, June 23rd. Goods cannot be received or despatched during these periods.

Consular Notes.—United States.—The British Consul at Baltimore reports that there is in course of construction at the shipyard of Messrs. Boz Brothers, Baltimore, an electrical equipment for hauling up vessels on their marine railway. It consists of a chain hoist operated by a 150-H.P. electric motor, and it is expected that it will haul up a vessel of 2,000 tons in 30 minutes.

The construction of the Susquehanna Dam at McCall's ferry—which ceased for ten months in 1908 owing to financial difficulties and the company being placed in the hands of a Receiver—was resumed in 1909 after being sold at auction for $2,000,000 to a new company called the Pennsylvania Water and Power Co. Work progressed rapidly after the sale, and in September, 1910, it was completed. The dam, which has been referred to in previous reports quoted in the ELECTRICAL REVIEW from time to time, is 3,000 ft. long, with a varying height of from 50 to 100 ft. according to the bed of the river. It is 68 ft. wide at the base, with the outer wall built in the form of a parabola so as to throw the water away from the bottom of the wall, and to prevent undermining. It contains 380,000 cb. yds. of concrete. A lake 8 miles

long by ½ mile wide has been formed by it, which is said to contain about 32,000,000,000 gallons of water. The power house contains ten large water-wheels and two dynamos weighing 400 tons, capable of producing 13,500 H.P. each, at 94 R.P.M. The contract for the supply of electricity made by the original company with the Consolidated Gas, Electric Light and Power Co., of Baltimore, has been carried out by the present company, and the current was introduced into Baltimore on October 14th, 1910. The Baltimore Co. controls the lighting by electricity from this source of eight counties in Maryland. The United Railways Co. (tramways), with whom the original owners of the dam had also made a contract, have not yet made use of the current.

The Chief Engineer of the Sewage Commission proposes as soon as the sewage disposal plant at Back River—the point of the final discharge of the sewage into the Chesapeke Bay—is completed, to use the fall of the water after it has passed through the various tanks, which will be 18 ft., to operate turbines for the generation of electricity. It is expected that the quantity of water passing from the outfall with produce about 455 H.P. The intention is to light and operate the disposal works with the current produced, and the Chief Engineer believes that the surplus will be sufficient to light the City Hall and Court House in Baltimore.

The construction of underground conduits for electric wires goes rapidly forward, and is gradually eliminating from houses and streets the unsightly overhead wires and poles. To December, 1910, there had been constructed 9,463,650 duct ft., which, with the necessary manholes, junction and service boxes, buildings connected, &c., cost $2,560,631. The rentals received for the use of the conduits average $100,000 a year. The police and fire alarm telegraph occupies 103,000 ft. of the conduits, and there are several thousand feet occupied by municipal and Government cables, for which no rental is received.

Turbo-Blower.—At the invitation of the British Westinghouse Electric and Manufacturing Co., Ltd., a number of managers of iron and steel works, and others interested, paid a visit to the company's works at Trafford Park, on Monday and Tuesday last, to inspect the test of a mixed pressure turbo-blower for operating in connection with blast furnaces. The blower has a capacity of 25 cb. ft. of free air per minute, against 8 to 10 lb. pressure. Considerable interest in the test was displayed, and every facility for inspection was afforded, the visitors being accompanied in their tour by several Westinghouse engineers.

LIGHTING and POWER NOTES.

Aberdeen.—The recent breakdown in the supply of electricity has occupied the attention of the Corporation Electricity Committee. The engineer reported that the breakdown was due (1) to the drawing of a heavy current to a faulty cable in Union Street, due to a pick hole in the cable; (2) the overloading of the boiler steaming at the time; and (3) owing to one of the mechanical stokers failing to operate, the steam was reduced to such a degree that it was found necessary to shut down the station until the mechanical stoker could be put right and steam brought up again.

Barnstaple.—The T.C. has received from the L.G.B. sanction to a loan £1,442 for E.L. purposes. The sum applied for was £1,970.

Barrow-in-Furness.—At the T.C. meeting on Monday, Alderman Smith presented the annual report on the working of the borough electricity works. The capital expended on the works totalled £115,000, and £30,167 had been repaid. With regard to the revenue, they had had an increase of nearly £1,200, whilst, at the same time, the costs had gone up a little over £500. The result was that the gross profit was increased by the sum of £645 as compared with 1909-10. There was an increase in the net profit of £456, or the net profit, which last year stood at £249, was now £706. The units sold had increased from 1,130,092 to practically 1¼ million. They hoped, during the coming year, to secure one of the largest consumers, which would have the result of materially improving the output. If that should prove to be the case, the Committee would have to come to the Council for further capital. It was in that direction they must look for any further economy.

Beckenham.—The Council has received from the L.G.B. sanction to a loan of £5,000 for free wiring.

Blackburn.—Current for Coronation illumination will be supplied by the T.C., free of charge, subject to approval of the devices, and the payment of expenses incidental to connecting them.

Canada.—According to the *Globe* (Toronto), Mr. E. A. Robert, of the Canadian Light and Power Co., has placed before the Dominion Government a project for the development of electrical energy at Cedar Rapids, on the St. Lawrence River, at a cost of between 15 and 20 million dollars. The plan includes huge chutes over the Coteau and Cedar Rapids, about 25 miles above Montreal. It is estimated that 500,000 H.P. could be developed there.—*Board of Trade Journal.*

Continental Notes.—NORWAY.—The Norwegian Ministry recently requested the Director of Canals to prepare a scheme for the utilisation of the so-called Nore Falls in the district of Telemarken in the south-eastern part of the country. The project has now been completed, and the municipal authorities of Christiania have at present under consideration a proposal made by the Ministry that the city should be furnished with electrical power from the State waterfalls in Telemarken. It is calculated that the falls would be able to yield 155,000 electrical H.P. by the use of turbo-generators, and the total expenditure on the hydro-electric works is put at £1,000,000, of which £200,000 would be required for the regulation of the waterfalls. As an instalment, one-half of the scheme would be proceeded with at first without, however, the cost per H.P. being increased, and the distance of transmission would reach a maximum of 77 miles.

FRANCE.—A new company has just been formed in Brussels with a capital of £100,000 and the title Gaz et Electricité de Roubaix, Compagnie Générale de Distribution d'Eclairage et de Force Motrice.

La Société Electrique des Vallees de l'Aisne et de l'Oise is the title of a new company which has just been formed at Compiegne with a capital of £60,000, to establish a generating station for the supply of electrical energy for lighting and power purposes in the district comprised in the title of the undertaking.

GERMANY.—The Salpetersaure Industrie Gesellschaft is reported to have decided on the establishment of a 10,000 H.P. central generating station in connection with its mines at Hohn (Hessen-Naussau) for the supply of the electrical energy required for its own use, also for lighting and power purposes to the towns and villages within a 30-mile radius.

BELGIUM.—La Societe des Charbonnages de Basse-Rancy, of Tilleur, has secured the contract for the supply of electrical energy for lighting and power purposes in the little town of Vaus-sous-Chevremont (Liége). The colliery company has agreed to supply the current at ·8d. per KW.-hour for the first 50,000 KW.-hours and at ·7d. for between 50,000 and 100,000 KW.-hours.

SPAIN.—A company, entitled the Electra Valenciana, has been formed at Valencia, with the object of distributing and selling electric energy supplied by La Hidro Electrica Espanola. The capital of the company is put at about £83,000.

ROUMANIA.—The communal authorities of R. Sarat have obtained permission to contract a loan of £14,000 for water supply extensions and for electric light works.

The Slatina communal authorities have obtained powers to contract a loan of £32,000 for electric light, paving, electric tramway material, &c.—*Board of Trade Journal.*

RUSSIA.—The municipal authorities of Chernikov have applied to the Council of Ministers for permission to raise a loan of about £10,500 for the purpose of purchasing electrical machinery for the central generating station, and converting the municipal debt.—*Board of Trade Journal.*

Coventry.—The Electric Light Committee reports a net surplus for the year of £16,414, as compared with £10,071 last year. This profit is the largest in the history of the undertaking. The Committee states that it has come to the conclusion that the excellent results of the year's working justify it in following a similar course to that adopted last year, and paying a bonus to the employés in the department. It accordingly recommends that as in the previous year, each employé receive a bonus equal to two weeks' pay, the arrangement, however, to be strictly in respect of the past year, and not to be regarded as a precedent. The Committee makes the following recommendations as to the disposal of the net profit of £16,414, to which has to be added £64 brought from the previous year, making together £16,478:—(1) That £3,500 be paid over to the general district fund in aid of the rates: (2) that £8,212 be paid to the reserve fund and transferred from that fund to capital account for cost of services, part cost of refuse destructor and remaining value of plant superseded, &c., as under, such sum to be applied in the purchase of further plant, in lieu of raising a loan for same, viz., £898 for plant superseded in connection with extension of a 3,000-KW. turbo-generating set; £2,736 for plant superseded in connection with extension of a second 3,000-KW. turbo-generating set; £259 for pipe-work superseded; £13 in connection with the sale of motors; £2,125, being half the cost of the capital expenditure in connection with the refuse destructor; £2,000 for services; £181 for wiping off capital expended in Parliamentary expense; (3) that £1,150 be paid to a suspense account and applied in payment of the following amounts:—£800 for the provision of a new workshop and tools, and office fittings; £350 for the replacing of condensing plants, for pumps; (4) that £3,000 be paid over to the reserve fund, bringing the total amount of the fund up to £6,087; (5) that £237 be applied in the payment of a bonus to the employés in the department; (6) that the balance of £379 be carried forward to next account.

The Council has adopted a revised scale of charges for the supply of electrical energy with the view of inducing an increased number of manufacturers to use it for motive power. The revised rates adopted were: for total consumption per quarter not exceeding 50,000 units 1d. per unit, 75,000 units ·95d., 100,000 units ·9d., 125,000 units ·85d., 150,000 units ·8d., and for a total consumption not exceeding 150,000, ·75d.

Cleckheaton.—Messrs. Charles Hirst & Sons, Ltd., manufacturers, of Exchange Mills, Cleckheaton, have just completed a well-equipped electric power station in connection with their factories. Plans for similar additions at other local mills are said to be in preparation.

Croydon.—In his report of the 14th year of working of the electricity department, the borough electrical engineer, Mr. A. C. Cramb, mentions that a decrease in output for public lighting and traction was experienced, although general supply added 240 000 units. During the year 5,935,000 units were sold, or about 636,000 units less than in 1910—the economical working of the tramways accounting for over 800,000 units decrease. The added capital

expenditure of £2,909 was entirely on distribution. Consumers were increased by 356 to 3,949. The great progress made in the reduction of the cost of producing electrical energy in Croydon is shown in the fact that in the last 10 years it is equal to 46 per cent., or, on the present output, £21,496 per annum. Councillor Betteridge, for the Committee, explained to the B.C. on Monday that despite a diminution of £5,372 in revenue for energy sold for traction purposes, and the fact that coal had cost 10 per cent. more, the profit for the 12 months was £30,691. After placing about £22,000 to payment of interest and sinking fund, a balance of £6,978 remained, which had been appropriated to the relief of the rates (making altogether £16,015 applied to the rates in respect of the year ending March 31st, 1911). There was now a reserve of £38,336. He proposed at the next meeting to move a further reduction of charges to consumers. Several factories have recently started in Croydon, it is stated, owing to the cheap supply of electrical power available.

Douglas (Isle of Man).—The T.C. has decided to obtain reports from local firms on the installation of the E.L. at the Town Hall and Library.

Eccles.—The Lighting and Electricity Supply Committee has recommended the T.C. to apply to the L.G.B. for a loan of £666 for street lighting by electricity.

Glasgow.—In connection with the installation of the electric power for the aerial railway at the Scottish National Exhibition, the T.C.'s Tramways Committee has arranged for the attendance of two of its employés on the railway under the superintendence of the inventor, on the understanding that the Committee will be relieved of all responsibility in connection with accidents or otherwise.

Grantham.—The Urban Electric Supply Co., Ltd., has obtained the consent of the R.D.C. for the supply of energy to Gonerby House, and to property in Belvoir Avenue, which are outside the area of supply.

Ilford.—A L.G.B. inquiry was held on May 25th respecting the application of the U.D.C. for a loan of £8,070 for E.L. purposes. The loan is for a feeder to the Broadway, conduits and distributing switchboard, a cable to the Garden City, house services and excess expenditure on meters. There was no opposition.

Kingston-on-Thames.—There was a gross profit on the last year's working of £5,428, and the net result of the twelve months' working was a debit balance of £1,192 as against a debit balance of £1,644 for the corresponding period of 1910. The receipts had increased from £10,906 to £11,983, while the expenditure had risen from £12,551 to £13,175. The undertaking was still suffering, though in a less degree, from the continued substitution of metallic-filament lamps for the older type of lamp. The total loss to the ratepayers up to March 31st, 1911, on the undertaking was £15,215. Mr. Hall, in criticising the report, said that as a last resort they had the opportunity of placing the undertaking on the market, and he thought that would be better than going on in such an unsatisfactory manner.

Leigh.—According to an official report just issued, there was a profit of £488 on the municipal electricity works during the past year.

Llandudno.—The question of improving the lighting of the promenade has been under consideration by the Electricity Committee, and the U.D.C. is to be asked to consider a scheme of alternate lamps between the existing columns, and to instruct the engineer to prepare an estimate. The Committee also approved of the suggestion to illuminate the shelters on the Promenade on the occasion of the Coronation and Investiture, the cost to be defrayed out of the sum voted by the Council for Coronation purposes.

London.—ST. PANCRAS.—Communications having been received from consumers urging the reduction of the charges made for the outside electric lighting of their business premises, the Electricity Committee has given the matter careful consideration. Energy for this class of lighting is charged for under the rates in operation for the general electric lighting of consumers' premises, which are as follows:—(1) Flat rate of 4d. per unit; (2) maximum demand indicator system of 6d. per unit for the first hour and 1½d. per unit after; (3) 6d. per unit between the hours of 4.30 p.m. and 8.30 p.m., and 1d. per unit after, and payment of cost of meter, &c., for registering supply. From a return of information obtained, it appears that lower charges than the above are made for the electric lighting outside business premises in other districts, as follows:—Battersea, 2½d. per unit; Beckenham, 3d. per unit, or at an inclusive charge per hour; Bermondsey, 2½d. per unit, conditional on light being used inside also; Finchley, £5 15s. 3d. per 383 hours per annum per 5-ampere circuit at 250 volts; Heston and Isleworth, 3d. per unit; Ilford, enclosed arc lamps, 600-watt, £3 per 500 hours, inclusive of carbons and trimming; Southwark, 3d. per unit. At present the approximate revenue from outside private electric lighting is £5,000 per annum, but the engineer is of opinion that, unless the charges are lowered, this sum will decrease. To meet the demands of the case, the Committee has decided, subject to the usual sanction, that the flat rate charge for energy supplied for outside frontage lighting of business premises be at a special rate of 3d. per unit, as from and after the reading of the meter indices at the close of the current June quarter, and that rentals be charged for the separate meters required to register the supply.

POPLAR.—Application is to be made to the L.C.C. for a loan of £42,455 for the electricity undertaking. A new agreement is to be entered into with the Port of London Authority for the supply of electricity to the Docks, on the following basis: "The Port Authority to take 750,000 units per annum for general use, with a maximum demand of 150 KW. on the Council's peak, and about a further 100,000 units per annum for Millwall dry dock pumps, with a maximum demand of 350 KW., but the dry dock main pumps shall not be worked upon the Council's peaks. The peaks to be considered as being between 4 p.m. and 6 p.m. on week days in November, December, January and February. The price to be 60d. per unit, flat rate, D.C., at a pressure of 230 or 460 volts. The existing wayleaves for cables to be reduced, also the rental of the sub-station site near East Ferry Road. The foregoing rates to commence on October 1st next, and the quantity of 750,000 to commence January 1st, 1912. The agreement to provide for supply until the end of 1921." The minimum supply to be taken is an increase of 250,000 units over that provided by the existing agreement. The maximum is at present liable to go beyond 500 KW. upon the peak load, while under the terms of the agreement it will be restricted to 140 KW.

STEPNEY.—The abstract of the balance-sheet of the electricity undertaking for the year ending March 31st last shows a total amount actually borrowed of £403,896. Of this £41,497 has been repaid. The capital commitment during the year amounted to £41,045. The total income was £57,636, being an increase over the previous year of £5,370, while the total expenditure was £33,528, an increase on the previous year of £2,078. The gross surplus was £24,108, which represented a gross profit of 6·4 per cent. on the capital employed. There had been an increase in the number of units sold from 8,009,174 to 9,106,293. The net profit was £1,769, as compared with £1,515 in the previous year. It is proposed to bring £1,100 to reserve, carrying forward £2,097 to next year's account, as against £2,128 brought forward from the previous year. During the 11 years' working of the undertaking there was a surplus of £25,885. Of this £6,955 had been expended upon capital assets in respect of which it had not been desirable to borrow; £8,055 had been written off capital account in respect of assets gone out of use for various reasons, and £5,878 was incurred for work not directly concerned with the normal working of the undertaking (*e.g.*, removal of plant from Whitechapel to Limehouse), leaving £5,000 to reserve for contingencies.

FULHAM.—Mains are to be extended at an estimated cost of £1,163 to the Crabtree Farm Estate, where it is proposed to erect 225 houses and shops. The L.C.C. recently passed plans for the development of the estate, and the agents are prepared to undertake the wiring, complete with fittings, of all houses on the estate. A flat rate of 2d. per unit is to be charged for energy used for Coronation illuminations, plus a minimum inspection fee of 5s. per installation. There is an excess of income over expenditure in the electricity undertaking for the year ending March 31st last of £3,861, which, with the balance brought forward from the previous year, leaves an available surplus of £6,235; £3,000 of this is to be transferred to the machinery maintenance reserve account.

Maidstone.—The Electricity Committee of the T.C. has approached the Incorporated Municipal Electrical Association with a view of getting that body again to promote a Bill in Parliament granting powers to all undertakers, being local authorities, to provide, let for hire, &c., but not manufacture, lamps and other electrical fittings and wires on consumers' premises.

Newport (Mon.).—The Electricity and Tramway Committee has recommended the T.C. to adapt buildings in Clarence Place for use as offices, showrooms and stores for the undertaking, at an estimated cost of about £2,000.

Romford.—The Electrical and Engineering Supply Co., Ltd., is extending its mains to the Harold Wood district in the area of the R.D.C.

St. Helens.—An inquiry has been held by Major Stewart, of the L.G.B., into the application of the Corporation for sanction to borrow £10,800 for extensions to the electricity power station at Croppers Hill, rendered necessary by the great increase in the output of energy during the past few months, and the anticipated increased demand of next winter. The deputy town clerk explained that the total units sold during the year ended February 28th last amounted to 4,024,114, as compared with 2,736,784 for the corresponding period last year, and the maximum load had increased from 1,100 KW. to 1,880 KW. It was anticipated that the maximum load next winter would be at least 2,500 KW., and in the event of the failure of the 1,000-KW. turbo-alternator, or the 500-KW. machine, the whole of the supply could not possibly be maintained. The fact that the supply was split up into three distinct sections, traction, direct current lighting and power, and three-phase lighting and power, further emphasised the necessity of the proposed extensions. Full details regarding the scheme were given by Mr. Hollingsworth, the electrical engineer.

Stoke-on-Trent.—The Electricity Committee of the T.C. has been requested to consider the advisability of reducing the price of current to the Stoke and Burslem destructor works to 1d. per unit for both lighting and power.

Counsel and expert witnesses are to be engaged by the T.C. in support of the application for a loan of £60,000 for electricity purposes.

The B. of T. has been asked to consent to the supply of current in the borough on the extra tension three-phase system.

Mains extensions at a cost of £558 have been sanctioned, including a supply for the new infirmary buildings at Hartshill.

Wrexham.—The T.C. has applied to the L.G.B. for a loan of £500 for public lighting by electricity.

Walthamstow.—From the date of the March quarter meters readings, the price for current to lighting consumers is to be reduced by ½d. per unit. An equivalent reduction is to be made for current supplied under the Osram lamp maintenance scheme. The inclusive arc lighting rate of £4 per lamp of 500 hours burning is to be reduced to £3 15s. for flame lamps, and £3 10s. for lamps of the enclosed type. Application is to be made to the L.G.B. for sanction to borrow £5,149, the estimated cost of laying a feeder cable to Blackhorse Lane.

West Ham.—At the last meeting of the T.C., the E.L. Committee reported that it had considered a report from the electrical engineer with regard to the extension of the electricity undertaking. The estimates were approved, and the amount of money asked for was £53,000 for new plant and buildings at the generating station, and £6,000 for the extension of mains. The engineer, in his report, stated that the time for patching up was gone, and it had become necessary to extend on the most efficient and up-to-date lines. This will enable electrical energy to be produced at the very lowest possible figure, which would extend the undertaking on sound lines. The B. of T. has sanctioned the borrowing by the Council of the sum of £18,113 for the construction of the Prince Regent's Lane tramways.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The traffic receipts of the Corporation tramways since last June amount to £70,975, an increase over those for the same period of the preceding year of £2,120. This is a record result in the history of the department. At a meeting of the Committee it was agreed to continue the jointing of the Union Street rails further west than has been done, and also to continue experiments with the welding of joints. The question of the provision of screens in the front of cars for the protection of motormen was deferred, as was also the question of the extension of the tramways to Footdee.

Barrow-in-Furness.—The borough electrical engineer has been authorised to obtain and erect the overhead equipment which is required in connection with the extension of the tramway system to Biggar Bank, Walney Island. He proposes to carry out the work by direct labour, the bulk of the skilled work being carried out by men already in the employ of the electricity department. The T.C. on Monday approved this course, and the electrical engineer was also instructed to prepare plans in connection with the overhead equipment in Ferry Road.

Belfast.—The working of the Cavehill and Whitewell Tramway Co.'s line by the Corporation of Belfast was to begin to-day. This decision was come to at a special meeting of the Tramways and Electrical Committee on Monday. A resolution passed by the Law Committee approving of the agreement with the Cavehill and Whitewell Tramways Co. for the taking over and working of the tramway was read, and after discussion it was agreed that the Corporation should take over and run the tramways on and from 2nd prox. Instructions were given to Mr. Bloxham, the city electrical engineer, and the surveyor's department, to have the necessary connection between the city system and the company's system completed. The City Hall has been fixed as the city terminal instead of Castle Junction, to prevent congestion which would be caused by cars turning at the Junction. The agreement by which the Corporation will work the line for the present is without prejudice to the legal questions arising out of the arbitrators' award, which have still to be adjudicated on by the courts.

Blackburn.—In his annual report on the Corporation tramways, the manager says the decrease of 22,430 miles, 128,485 passengers and £1,217 receipts was due to inclement weather on market days and Sundays. The consumption of current had been reduced from 1·83 to 1·81 units per car-mile, thus effecting a saving on the mileage run of £121 on the year. The average total revenue per car-mile was 12·66d., and the average working expenses, 8·21d. per car-mile.

The manager, in his report, says meters for registering the consumption of current on the cars are being experimented with in many towns; he has made tests with meters on his system, but, as is the case elsewhere, no reliable meter has been met with up to the present time. If, at a later date, any tangible results can be shown by the adoption of meters on cars, he will bring the matter before the Committee. Presumably this refers to Blackburn conditions particularly.

Blackpool.—The Tramways Committee has decided to allow all children to ride free of charge on Coronation day. The two tramway companies were asked to grant the same privilege within the borough boundaries. The Lytham company replied in the affirmative, but the Fleetwood company regretted it was unable to do so.

Bexley.—The U.D.C. has decided to apply to the B. of T. for a loan of £1,280 for the equipment of the cars with electro-mechanical brakes. A trial is to be made with the equipment of the Electro-Mechanical Brake Co.

Canary Islands.—An application has been lodged with the "Direccion General de Obras Publicas," Madrid, by the Sociedad Anonima Banco di Castilla for a concession for the construction and working of an electric tramway between the Barrio de San José and the centre of the City of Las Palmas.—*Board of Trade Journal.*

Continental Notes.—SWITZERLAND.—An 80 years' concession has been granted for the construction and working of a narrow-gauge electric railway from Worblaufen by way of the valley of Worblen, whence it will join either the railway at Worb or the Berthoud-Thoune line, with a branch from Schermen to the communal boundary of Berne. The cost of construction is estimated at £64,552. An 80 years' concession has also been granted for the construction and working of a narrow-gauge electric railway, 50 miles long, from Coire to Bivio *viâ* Lenzerheide, Tiefenkastel and Oberhalbstein. The cost of construction is estimated at £340,000.

NORWAY.—It is reported that the Norwegian State Railway authorities are considering the question of adopting electric traction on the Christiania-Asker section of the railway to Drammen.

GERMANY.—The South German Railway Co. is reported to be considering the question of adopting electric traction on the railway between Zell, Schonau and Todtnau, in Baden.

The question of converting the Berlin city and circle railways to electric traction has been under the consideration of the State railway authorities for a number of years past, and it is now declared to have been advanced a stage as a result of a statement recently made by the Prussian Minister for Railways in the Budget Commission of the Prussian Lower House. According to former plans prepared by the railway authorities, an expenditure of £9,000,000 would be needed for reconstructing the lines and providing entirely new rolling stock, but the large outlay has always stood in the way of the carrying out of the scheme. The experience gained in the working of the Blankenese-Hamburg-Osdorf suburban railway and the trials made on the Bitterfeld-Dessau railway, have, however, shown that the transformation of the Berlin railways could be carried out quicker and at less expenditure by the adoption of electric locomotives and by retaining the existing rolling stock and tracks. The supply of current would be by overhead conductors as at Hamburg. It is in contemplation to erect a large power station at Bitterfeld as an extension of the existing station which was built for the working of the Bitterfeld-Dessau railway, and the power would be transmitted to Berlin at a pressure of 60,000 volts. This means that the original idea of erecting two generating stations in the vicinity of Berlin has been abandoned. On the other hand another version of the scheme implies that only one portion of the railways would be taken in hand at first, at an estimated expenditure of £1,800,000. It is added that the first instalment of the outlay will be included in the Prussian Budget for 1912 or 1913.

RUSSIA.—Applications have been made to the Russian Ministers of Finance and Communications for concessions to construct two electric railways. The first relates to a railway from Moscow to Ssergiewski—Possad, with branches to the three northern railway stations, the whole length being 69 versts, and the estimated expenditure on construction being £867,000. In the second case the railway would connect Sevastobol with Aluschta, *via* Jalta, and would be 126 versts long. The outlay is computed at £2,815,000, of which the greater portion would be raised by the issue of non-guaranteed bonds.

H.M. Consul at Batoum reports that, according to the Caucasian newspapers, a British subject, an electrical engineer, has applied for permission to promote a scheme for utilising some of the river and lake waters of the Highland districts of the Caucasus for the generation of electricity. A technical Commission appointed by the Russian Government has approved of such an undertaking, and has elaborated conditions under which a concession should be granted to the applicant. The engineer in question proposes to build a large hydro-electric station at Lars, on the Georgian military road beyond Vladikavkaz, for the Northern Caucasus, and another on Lake Gotchkha, in the Government of Elizavetpol, for the Trans-Caucasus. The local Press states that the scheme will naturally lead to the construction of an inland electrical railway over the main Caucasian chain, connecting Vladikavkaz directly with Tiflis. Further particulars may be obtained by British manufacturers on application to the Commercial Intelligence Branch of the B. of T.

BAVARIA.—The Bavarian Ministry of Communications has just granted a preliminary concession in respect of a projected electric railway from Bregenz up the Pfander mountain.

PORTUGAL.—An application has been submitted by the Companhia Carris de Ferro de Lisboa, for a concession for the establishment of an electric tramway in Lisbon, viz., between the Largo do Intendente and the Rua dos Anjos, by way of the Avenida Almirante Reis.

MONTENEGRO.—The Belgian Legation at Cettinjé states that the Montenegrin Government has recently granted to a private individual, various concessions for the establishment of hydro-electric works, the electrification of the Antivari-Virpazar railway, and the construction of electric railways.—*Board of Trade Journal.*

Croydon.—Acting on an exhaustive special report by the manager (Mr. T. B. Goodyer), the Tramways Committee of the B.C. has declined to recommend any alteration of existing fares or stages. Amendments moved on Monday to introduce ½d. fares and lower the workpeople's fares (which average 1d. for nearly three miles) were lost. Regarding workpeople's fares, it was pointed out that these mean a loss now approximately of £1,713 per annum; and that the ordinary 1d. and 2d. fares in Croydon are less than the workpeople's statutory fare, viz., ½d. per mile, the margin of

profit per passenger being extremely small—·089d. Mr. Goodyer held that any scheme for altering fares might turn the present satisfactory balance into a huge loss. The Committee recommended the re-opening of the Whitehorse Road route, closed three years ago because of being unremunerative. The loss was estimated at over £2,000 a year. An amendment was carried by 24 votes to 21 deferring the re-opening till the rates had been reduced, or the manager could advise that in his opinion it could be done without loss. The total capital outlay on the tramways since their purchase in 1900 has been £282,115, which debt has since that year been reduced by £66,138. To the relief of the rates £4,800 has been paid, and at March 31st, 1911, there was an estimated reserve and renewals fund of £28,881.

Glasgow.—On the occasion of the Coronation of King George, arrangements have been made by the Corporation's Tramways Committee to convey children of the city schools on the cars gratis to the Scottish National Exhibition, where a special entertainment has been arranged.

Java.—A Mr. Huber has applied for concessions for the construction of the following tramways in Sourabaya, Java:—(1) A steam tramway from Wonokromo to Koepang, (2) an electric tramway from Groedo by Goebang station to the Simpang cross road, (3) an electric tramway from Willemsplein, *via* Heerenstraat and Grisseeschen Road to the harbour.—*Board of Trade Journal.*

Keighley.—The Tramways Committee has resolved that application be made to the B. of T. for a further extension of time for the construction of tramways from Dale Street to Stockbridge, and for the commencement and completion of the tramways authorised by the Keighley Corporation Tramways Order, 1909.

Middlesbrough.—The T.C. has resolved to oppose the Stockton, Thornaby and Middlesbrough Imperial Tramway Co.'s Bill in Parliament, under which they seek powers to extend the tramlines from Middlesbrough towards South Bank, and purchase the toll pass thereon. Middlesbrough and Thornaby Corporations and North Ormesby District Council object to having to contribute to the cost.

Rochdale.—The gross profit of the Corporation electric tramways last year was £28,645. The accounts show a surplus of £1,944.

Torquay.—The extension of the tramways to Paignton is expected to be finished and the cars running by the middle of July. The erection of the standards was commenced last week, and these have already reached Preston. The new cars for the extended route will arrive at Torquay some time next week.

Stockport.—The proposal of the Tramways Committee to run railless cars from St. Petersgate, along Wellington Street to Churchgate and Offerton, has caused an outcry among the tradespeople in the Market Place, who consider that the proposed new cars should run through the Market Place. A meeting of protest against the proposed new route was held on Monday night, and a deputation was appointed to interview the Tramways Committee on the subject. Mr. G. Bennett said it was contrary to the interests of the town to leave the Market Place high and dry, and Mr. A. Crossley said if the present proposal was carried it would mean the cutting-off of the Market Place, which would soon be a dead end.

Treeton.—The P.C. has passed a resolution giving hearty support to the proposal of the Rotherham T.C. to provide railless cars in the parish. If necessary, a member of the Council will give evidence before the Select Committee.

West Ham.—The T.C. proposes to promote a Bill for extending the electric tramways by a double line from the Forest Gate terminus to Wanstead, *via* the Flats, thence to Bushwood Road, and on to Leytonstone. The consent of the Wanstead and Leyton Councils is to be sought, and the Bill also seeks to enable East Ham, if it so desire, to extend its tramway from the Ilford Cemetery terminus to connect with the proposed new line.

TELEGRAPH and TELEPHONE NOTES.

Rural Telephones.—The Postmaster-General has promised to extend the farmers' £3 party-line service to other persons connected with rural industries, and to medical men.

Telephone Transfer.—The Solicitor to the General Post Office having asked the Corporation of the City of London to support the case of the Post Office before the Railway and Canal Commissioners, the Streets Committee requested Mr. A. C. Morton, M.P., to give evidence in favour of an underground system.

On May 18th Mr. Faithful Begg addressed the London Chamber of Commerce in favour of the proposal to constitute a special Telephone Authority, free from political control; if the system fell under the paralysing influence of State monopoly, he said, development would be arrested.

Wireless Company Frauds.—Reuter reports that "C. C. Wilson, the president of the United Wireless Telegraph Co., and four of his associates have been found guilty of misuse of United States mails in soliciting stock subscriptions. Wilson was sentenced to three years' imprisonment, and the others to sentences of one or two years' each. Mr. Bogart, vice-president of the United Wireless Telegraph Co., who pleaded guilty to misuse of the mails in soliciting stock subscriptions, was fined $2,500 by the Federal Court."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—June 14th. Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

June 14th.—Cable, ironwork, cast-iron pipes, iron or steel poles, phosphor-bronze wire, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" May 5th.

July 19th.—Insulators, telephones, copper wire and iron wire, for the P.M.G.'s Department in Queensland. See "Official Notices" to-day.

June 27th.—1,400 protectors for use on main distributing frames at magneto exchanges, for the P.M.G.'s Department in Victoria. See "Official Notices" May 5th.

MELBOURNE.—July 11th. Deputy P.M.G. 12½ miles of switchboard cable (schedule 503). Specification can be seen at the Board of Trade C.I. Branch, E.C.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp-signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

Barnes.—June 9th. Pipework, &c., and one 600-KW. generator panel, for the U.D.C. See "Official Notices" May 26th.

Beckenham.—June 12th. Electric wiring of houses, for the U.D.C. See "Official Notices" May 19th.

Blackpool.—Arc lamp carbons for two years, for the Corporation Electricity Department. See "Official Notices" May 26th.

Canada.—July 3rd. Apparatus and material for a police patrol telegraph system. Specification, &c., from Mr. F. A. Cambridge, city electrician. A copy can now be seen at the Board of Trade Commercial Intelligence Dept., London. Tenders to Chairman, Board of Control, Winnipeg.

Derby.—Coal for the Corporation electricity works.

Devonport.—June 8th. D.C. meters, paper-insulated cables and rubber-covered wires, for the Corporation. See "Official Notices" May 26th.

Eccles.—June 10th. The Education Committee invites tenders for various scientific electrical apparatus for the new schools. Specifications and forms of tender from the secretary of the Education Committee. S. H. Meave, Town Hall.

Egypt.—June 15th. Complete electric pumping plant, for Minister of Public Works, Cairo. Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Westminster. Specifications (two guineas deposit) from Controller-General, Main Drainage Department, Public Works Ministry, Cairo.

Heston and Isleworth.—June 14th. Metallic-filament lamps for street lighting (400 posts), for one year, for the U.D.C. See "Official Notices" May 19th.

London.—L.C.C.—Selected firms are to be invited to tender for a small workshop, store and offices at the Stockwell sub-station (£2,820).

July 4th.—Four electric traversers for car-sheds. See "Official Notices" May 26th.

STEPNEY.—June 8th. Ampere-hour meters, demand indicators, time-switches, and arc lamp carbons, for a year, for the B.C. See "Official Notices" May 19th.

The General Purposes, Staff and Education Committee is to obtain tenders for the electric light installation at St. George's Town Hall (£250).

June 12th.—Hemp and steel wire lift ropes for 3 years for H.M. Office of Works. See "Official Notices" to-day.

POPLAR.—June 19th. One 3,000-KW. turbine alternator, with surface condensing plant, two water-tube boilers with superheaters, air heaters, fans and chimneys, one 30-ton electric overhead travelling crane and water-softening plant, for the B.C. See "Official Notices" May 26th.

June 30th.—Surface condensing plant at the South Kensington generating station for H.M. Office of Works. See "Official Notices" to-day.

Mr. Killingworth Hedges is inviting tenders for lightning conductors for New Scotland Yard. See our advertisements to-day.

Lincoln.—The T.C. invites tenders for cobbles and slack for the electricity works for a year.

Mexborough.—June 10th. Balancer-booster set for the U.D.C. Electricity Department. See "Official Notices" May 26th.

New Zealand.—One each 15 and 20-H.P. electric motors and two sets of gear, for the Auckland Harbour Board. See "Official Notices" May 19th.

Oldham.—One 1,200-KW. mixed-pressure steam turbine coupled to two D.C. generators in tandem, with barometric condenser, pumps, &c., for the Corporation. See "Official Notices" May 26th.

Pembroke.—June 7th. Coal-conveying apparatus for the Council's electricity works. Mr. J. C. Manly, clerk, Town Hall, Ball's Bridge, Pembroke.

Portsmouth.—June 14th. Coal (10,000 to 12,000 tons per annum) for the Corporation electricity works; G. Hammond, Etherton, Town Clerk.

Spain.—The municipal authorities of Mentuda (province of Toledo) are inviting tenders for the concession for the electric lighting of the town.

June 21st. The Harbour Works authorities at Cadiz are inviting tenders for the supply of four electrically-operated cranes.

Stockport.—June 14th. Materials for the Corporation Electricity and Tramways Departments. See "Official Notices" May 26th.

Swansea.—June 13th. Continuous-current motors and starting switches for one and two years, for the Corporation. See "Official Notices" to-day.

Swindon.—June 20th. Battery, traction booster, three-wire hand regulated booster, and switchgear for the Corporation electricity works. See "Official Notices" to-day.

Turkey.—June 26th. Electric accumulators for the Ministry of War for the fez factory at Eyoub and for the tailoring workshop at Ahir Capou Local representation. See *Board of Trade Journal*.

Worthing.—June 12th. Two Diesel oil engines and continuous-current generators, for the Corporation. See "Official Notices" May 19th.

CLOSED.

Australia.—Messrs. Willans & Robinson, Ltd., have received an order from the Queensland Government Railway Commissions for a 750-KW. Willans impulse-disk and drum turbine, with a General Electric Co.'s two-phase alternator and surface condensing plant. This turbine will be capable of giving its normal full load with high-pressure steam or with any mixture of high-pressure and exhaust steam, and is intended for installation in the Ipswich Locomotive Works.

Aldershot.—The D.P. Battery Co., Ltd., have secured the contract for the new storage battery for the electricity works.

Barking.—The U.D.C. has accepted the tender of Mr. A. E. Symes, of Stratford, for the extension of the electricity works, at £2,497.

Bath.—Messrs. Kendall & Son are carrying out the electrical decorations of the Guildhall, &c., for the Coronation.

Belgium.—No fewer than 14 concerns—eight German, three British, two Belgian, and one French—submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels for the supply of a quantity of telegraph cables, the lowest offer being that of the A.E.G. Union Electrique, of Brussels. The British firms that competed were Henley's Telegraph Co., Callender's Cable Co., and the British Insulated and Helsby Cables, Ltd.

Bolton.—The Tramways Committee has accepted the tender of Mr. E. Dewhurst for the supply of automatic tramway signals.

Bristol.—The Docks Committee on Monday accepted the following tenders:—

Johnson & Phillips, Ltd.—Cables and wiring for sheds at Royal Edward Dock.
J. H. Tucker & Co.—Main switchboards for the same sheds.
Simplex Conduits, Ltd.—Conduits for the sheds.

Croydon.—The tender of Messrs. Johnson & Phillips has been accepted by the B.C. for the supply of 51 magazine arc lamps.

Dublin.—The contract for the electric lighting installation at St. Mark's Church, Great Brunswick Street, has been secured by Messrs. Dockrell, Sons & Co., Ltd. Mr. A. E. Porte, M.I.E.E., who prepared the specifications, will supervise the work.

Eccles.—The T.C. has accepted the tender of Messrs. Matthews & Yates for three cyclone electric fans, with wiring, for the Town Hall, at £63.

Glasgow.—The T.C.'s Committee on Tramways Works and Stores recommended the acceptance of the following:—

Copper rail bonds.—United States Steel Products Co.
Tantalum traction lamps.—Siemens Bros. Dynamo Works, Ltd.
Steel rails, 500-600 tons.—Bolckow, Vaughan & Co., Ltd.

Great Central Railway.—This Railway Co. has recently placed an order with the British Westinghouse Electric and Manufacturing Co., Ltd., for one of their "petrol-electric" cars, which will shortly be put on the tracks in the London district for trial under the direct observation of Mr. Sam Fay, the general manager of the railway, preparatory to going into service on a branch line. The car in question, which is of the general type developed by the Westinghouse companies on the Continent, will seat 50 persons and be capable of hauling two trailers, seating 50 more, at an average speed of 30 miles per hour on the level.

Greenock.—CORRECTION.—The information as received for publication last week was incorrect. The contracts for the plant extensions for Dellingburn power station were placed as follows:—

Coal and ash bunkers and conveying plant and two water-tube boilers with chain grate stokers.—Messrs. Babcock & Wilcox, Ltd.
One 2,000-KW. turbo-alternator with condensing plant, and two 500-KW. rotary converters.—British Westinghouse Electric and Manufacturing Co.

Ilford.—At the last meeting of the Council the Electricity Committee recommended that the tender of the Union Cable Co., Ltd., at £1,304 8s. 10d., be accepted for cable. Mr. Philpot, in moving the adoption of the recommendation, said that 11 tenders had been sent in, seven from English and four from foreign companies. The difference between the lowest foreign and the lowest English tender was over £700. Upon inquiries being made, the lowest tender was withdrawn as inaccurate, and the amended tender submitted came to practically the same as the lowest English tender. As regards the next lowest tender, no information was available with regard to the firm carrying out any contract for the supply of cable in this country. The Union Cable Co. came next, and the Committee's inquiries with respect to this firm were satisfactory. They were unanimous in recommending that their tender for cable manufactured in Berlin be accepted. Mr. Philpot went on to say that all the British prices were just a few pounds one above the other, and these prices were all so much higher than the tenders from foreign firms, that the Committee held that it would be beneficial to the Council not only now, but in the future, if it at this meeting accepted the tender for foreign-made cable. Possibly it might not have to do this again, as, in his opinion, it appeared from the prices of the English tenders that something in the nature of a ring existed. The difference between the tender of the Union Cable Co., and the lowest English tender, was over £400.—The Chairman of the Council (Mr. Hammond) said that £400 in a contract of only £1,300 was a very serious difference.—Mr. Dane said that the Union Cable Co. was about to open a factory at Dagenham.—Mr. Golding said that strongly as he disagreed generally with employing alien labour, he felt bound in this case, very much against his wishes, to vote for the foreign tender.—Mr. Griggs said that he had always understood that English-made cable was better than foreign. Here, however, there was such a large difference in price, that he would not raise any objection to the passing of the recommendation.—Replying to questions, Mr. A. H. Shaw said that he had no experience with foreign cables of this class, but inquiries from towns where this cable had been used for many years had brought replies which were perfectly satisfactory. The specification was the same as that supplied to the English firms. The recommendation was agreed to.

Kingston-on-Thames.—The T.C. has accepted the tender of Messrs. Siemens Bros. & Co., for 880 yd. of ·1 sq. in. of low-tension cable at £185; and that of the Craig-Park Electric Cable Co., for 440 yd. of ·05 sq. in. high-tension cable, at £73.

Maldon.—The Essex Education Committee has arranged with Messrs. J. Sadd & Sons for the electric light installation at the new schools at Maldon, the firm also to supply current.

London.—ST. PANCRAS.—The B.C. received the following tenders for the supply of a 1,000-KW. motor-generator to the King's Road generating station:—

Crompton & Co.	£2,236	Dick, Kerr & Co.	£3,140
Siemens Bros. Dynamo Works	2,240	Holmes & Co.	3,159
British Westinghouse Co.	2,232	British Westinghouse Co.	3,163
" Alternative	2,390	British Thomson-Houston Co.	3,191
Bruce Peebles & Co. (accepted)	2,500	Lancashire Dynamo Co.	3,207
Brush Elec. Eng. Co.	2,625	Vickers, Ltd.	3,754
Electric Construction Co.	2,775	Ernest Scott & Mountain	3,845
General Electric Co.	2,896	Rees Roturbo Co., Ltd.	4,020

The electrical engineer stated that the best two offers were the alternative of the British Westinghouse Co., Ltd., and the tender of Bruce Peebles & Co., Ltd. Although the efficiencies of the British Westinghouse rotary would represent a saving, the Bruce Peebles set would require fewer auxiliaries, and would consequently be less expensive to maintain, and would also be easier to manipulate, which was an important matter for consideration, as the new plant was intended to be of special service in time of emergency. In comparing the cash prices of the two offers, extras to the switchgear to the value of £180 would have to be provided by the Council in the case of the British Westinghouse Co.'s offer, so that the two tenders would work out as follows: Bruce Peebles & Co., Ltd., £2,500; British Westinghouse Co., Ltd., £2,570. It was resolved to accept the tender of Messrs. Bruce Peebles & Co., Ltd., at £2,500.

The Council has received the following tenders for the supply of high-tension cables:—

The Standard Cable Co.	£880	B.I. & Helsby Cables	£942
Aubert Grenier & Co.	891	Union Cable Co.	951
Johnson & Phillips, Ltd.	920	Felten & Guilleaume	955
Western Electric Co. (accepted)	904	Glover & Co., Ltd.	967
W. T. Henley's Co.	925	Callender's Co.	968
Siemens Bros. & Co.	933	General Electric Co.	1,063

The Electricity and Public Lighting Committee stated that the works of the two first-mentioned companies are situated abroad, and if either of these offers were accepted it would involve loss of time and expense for the Council's chief electrical engineer to attend there and test the cable before delivery, there being no facilities in England in these cases for this very important operation. Under these circumstances the Committee have accepted the next lowest tender, viz., that of the Western Electric Co., Ltd., at £904. They have also accepted the tender of the Albion Clay Co. for the supply of stoneware ducts, at £297.

HAMMERSMITH.—The Electricity Committee is about to invite tenders for the extension of the boiler house.

The following tenders were received for a turbo-panel for the generating station :—

B.T.-H. Co.	(not according to specification)	£145
Siemens Bros., Ltd.		146
Ferranti, Ltd.	(recommended)	180
Electric and Ordnance Accessories Co., Ltd.		180
British Westinghouse Co., Ltd.		198
A. Reyrolle & Co., Ltd.		202
Bertram Thomas		203
Electric Construction Co., Ltd.		213
General Electric Co., Ltd.		225
Spagnoletti, Ltd.		237
Johnson & Phillips, Ltd.		240

The British Thomson-Houston Co., Ltd., are to supply a Tirrill regulator, at £105.

The tenders received for converting public arc lamps into metal-filament lamps in main roads are as follows :—

E.M.F., Ltd. (Wardle Lantern)		£240
Wardle Engineering Co. (Wardle Lantern)		245
Drake & Gorham (Wardle Lantern)		259
Pontifex & Co.	(recommended)	269
H. Harrison		264
"		277
General Electric Co.		303
Falk, Stadelmann & Co.		312
Lucy & Co.		324
H. Harrison		324
Reason Manufacturing Co.		361

L.C.C.—The following tenders were received by the Highways Committee for equipment at the third section of the central car repair depôt :—

(1) HORIZONTAL HACK SAWING MACHINES.

Buck & Hickman, Ltd.	(accepted)	£103
Edward G. Herbert & Co., Ltd.		123
The Judson-Jackson Co.		124
Burton Griffiths & Co., Ltd.		127
John Holroyd & Co., Ltd.		322

(2) PNEUMATIC LIFTING JACKS.

East Ferry Road Engineering Co., Ltd.	(accepted)	£79
F. W. Rowlands & Co.		120
Reavell & Co., Ltd.		146
S. H. Heywood & Co., Ltd.		178

The Fire Brigade Committee last year obtained three electrically driven motor escape vans from "Cedes" Electric Traction Co., Ltd. It is now proposed to obtain six other vans precisely similar for £5,472, including extras, from the same company. This time, however, Messrs. Johnson & Phillips, Ltd., will, as sub-contractors, supply the chassis fitted with wheel motors, and the Tudor Accumulator Co., the batteries. The Committee, in making the foregoing recommendation, say that the appliances already in use have so far proved satisfactory in every respect in districts where the gradients are moderate; "they are extremely handy for a rapid turn-out, and for ease of manipulation they are superior to any other form of traction." As they will take six months to deliver, the Brigade asked for authority to order before Whitsuntide.

The Highways Committee has recommended for acceptance the tender of Messrs. Rowley Bros., at £12,997, for the extension to the Streatham car-shed.

Maidstone.—The T.C. has accepted the tender of the Bambridge Patent Flexible Shaft Co. for a rail grinder, at £54.

Margate.—The T.C., on May 23rd, received the following tenders for the electric light installation at the new Fort Pavilion :—

Kingston & Co., Ltd., Margate	(accepted)	£730
Vitter & Hopper, Ltd., Ramsgate		747
Gordon & Lawson, Woolwich		789
F. Wilkins & Brother, Ltd., Liverpool		830
G. Weston & Sons, Ltd., London		836
J. W. Simpson, Margate		865
E. Morgan, Folkestone		879
Barlow Bros. & Co., London		890
W. Mackie & Co., London		893
Johnson & Phillips, Ltd., Charlton		900
Banbury Electrical and Motor Co.		920
Pudney & Co., Bury St. Edmund's		928
Philpot & Son, Canterbury		933
E. Newbold & Co., Sutton		938
T. W. Vaughan & Co., Ltd., Islington		943
C. J. Vickery, Ramsgate		960
Davis & Co., London		965
Tilley Bros., London		997
L. Atwells, Canterbury		998
E. M. Redfern, Ltd., Birmingham		1,049
Jackman & Marchant, Folkestone		1,062
J. T. Mayfield & Co., London		1,064
Albert Boston Co., London		1,113
Mann, Egerton & Co., Ltd., London		1,260

The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for a fire-alarm system, at £33.

Portsmouth.—The Council has accepted a tender for 200 steel tramway tires by Messrs. John Batt & Co., at £1 0s. 9d. each; also one from Messrs. Edward Le Bas & Co., for trolley wire, £423; one from Tramways Supplies, Ltd., for mechanical and bridle ears, at £31; and one from British Insulated and Helsby Cables, Ltd., for section insulators, at £24.

Rochdale.—In connection with the supply of 10 new cars for the through service to Bacup, the Tramways Committee has decided to recommend the acceptance of the following tenders :—

J. G. Brill Co.—Ten pairs of trucks, subject to their being suitable for magnetic brakes.
Brush Electrical Engineering Co.—Car bodies.
British Westinghouse Co.—Magnetic brakes.

The Corporation Tramways Committee has placed an order with Messrs. Siemens Brothers Dynamo Works, Ltd., for tantalum traction lamps for twelve months

Stoke-on-Trent.—The T.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works Co., Ltd., for two 600-KW. motor-generators, at £2,385, and that of the British Westinghouse Co., Ltd., for six transformers, at £44 10s. each.

Walthamstow.—The U.D.C. has accepted the following tenders in connection with the generating station :—

Midland Engineering Co.—Natural draught cooling tower, £900.
Concrete tank and foundations for cooling tower, £260.
Walsall Electrical Co.—Two switchboard panels, £247.
Hurst Nelson & Co., Ltd.—One spare set tramway wheels, £31 5s.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Friday, June 2nd. Visit to the collieries and sinkings of the Kent Collieries, &c. Leave Victoria Station at 11.20.

Royal Institution.—Friday, June 2nd.—At 9 p.m. Discourse on "Radio-telegraphy," by Commendatore G. Marconi.
Thursday, June 8th. At 3 p.m. Lecture on "Practical Progress in Wireless Telegraphy," by Mr. T. Thorne Baker.

Concrete Institute.—Wednesday and Thursday, June 7th and 8th. At 11.30 a.m. Summer meeting at Denison House, Westminster. In the evenings, annual dinner and conversazione.

Physical Society.—Friday, June 9th. At 9 p.m. At the Imperial College of Science. Paper on "The Measurement of Contact Differences of Potential," by Prof. Anderson and J. G. Bowen; and "Exhibition of a Model Illustrating the Passage of a Light Wave through Quartz," by Mr. H. S. Allen; and other papers.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued :—

Commanding Officer—COL. H. M. LEAF.

Monday, June 5th.—"A" Company. Technical drill, 7 to 9 p.m.
Tuesday, June 6th.—"B" Company. Technical drill, 7 to 9 p.m.
Wednesday, June 7th.—Gymnastic classes, 7 to 10 p.m.
Thursday, June 8th.—"C" Company. Recruits' infantry drill, 7 to 8 p.m.; technical drill, 7 to 8 p.m.
Friday, June 9th.—"D" Company. Recruits' infantry drill, 7 to 8 p.m.; technical drill, 7 to 9 p.m.
Saturday, June 10th.—No parades.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt. L.E.E.

THE NATIONAL TELEPHONE CO.'S ANNUAL DINNER.

ON the 25th ult. the seventeenth annual staff dinner of the National Telephone Co., Ltd., took place at the Hotel Cecil; Mr. Albert Anns, secretary, presided, as usual, and covers were laid for over 450 guests, amongst whom were the Postmaster-General, Sir Albert Rollit, Sir John Gavey, Mr. Alex. Siemens, Mr. S. Z. de Ferranti, Major O'Meara, and many other well-known men.

After the loyal toasts, the chairman proposed "The National Telephone Co.," remarking that the occasion was memorable as being the last of these annual gatherings. For the first time the Postmaster-General was present, and they extended a warm welcome to him and to the other representatives of the Post Office. The company had kept their wicket up for many years, and he thought it not improbable that on January 1st next they might still be "not out." The staff had been uneasy as to the conditions of service under the Crown; he believed all would come right—they had served the State as licensees, and the Select Committee of 1905 had recommended that no servant of the company should suffer from the transfer. They had embarked upon the colossal task of taking an inventory of all their property; some doubted whether all this work should have been necessary, but they had to carry out loyally the agreement of 1905. The extent of the company's business might be gauged from the facts that on December 31st, 1910, they had 1,570 exchanges, 530,000 stations, and a capital of 16 millions sterling, which, moreover, did not represent the amount expended on the undertaking, as many items had been paid for out of revenue. The royalty paid last year was £330,000, and by the end of 1911 the Government would have received 3¾ millions in royalties. Their rates and taxes were £150,000. Yet in spite of all these burdens, their net profit was over £1,100,000. The staff numbered over 17,000 persons, and for efficiency and loyalty was unexcelled. The approaching transfer was a transaction without a parallel in the history of the world, and the public would reap the benefit when the undertaking was given a free hand, unlimited capital, and statutory powers—none of which the company ever had. The company had been pioneers, and the verdict of posterity would be that they had deserved well of the nation. Now they drew near the parting of the ways, and some of them might have to go to the United States where competence was rewarded.

The toast, coupled with the name of Mr. George Franklin, was enthusiastically received. Mr. Franklin, responding, said that if man was born to trouble, the National Telephone Co., born of the Post Office 31 years ago, had been born to a succession of troubles. Parents often found children expensive, but the company had found their parents expensive; 23 per cent. of their net, and 10 per cent. of their gross earnings had been exacted for the past 31 years. Last year they transmitted 1,500 million messages; their gross income was 3½ millions sterling. A great burden had been cast upon the staff by the enormous inventory, and the board heartily appreciated the way in which the staff had taken it up, and those who stayed at home had done the work of their absent comrades. The policy supported by the board was that, on the transfer, all members of the company's pension staff must be placed on the established staff of the Post Office, under conditions not less favourable than at present, and that all unpensioned members should receive fair treatment. The trustees had decided to close the pension fund on December 31st and to distribute the assets.

Mr. S. J. Goddard proposed "Our Guests," and Mr. Herbert Samuel, rising to respond, was received with acclamation. He said that the points at issue between the company and the Post Office were being and would be decided with good feeling on both sides, and he stated that the interests of the staff in connection with the transfer had been fully considered; full justice would be done to every member of it. The conditions laid down in 1905 had been modified only in a sense favourable to the staff, the whole of which (with few exceptions) would be taken over irrespective of the length of service of its members. The medical and literary examinations would be waived. It had been decided that all members of the pension staff should be given credit for two years' extra service, and all contributors to the fund who assigned their share in the assets to the Postmaster-General would receive in exchange, credit for all the years of service they had spent with the company, as years of service with the State, for pension purposes. Those in the service of the company before the fund was established, would count all their years as Government service. All the staff would receive one week's additional leave per annum, on full salary. The staff had feared that they would be thrown in amongst the 200,000 employés of the Post Office, and that personal merit would be ignored; that would not be so. The telephone department would be kept to a great extent distinct from other Post Office work, and the wise policy of the company would be followed in allowing a large measure of discretion to local officers. They would encourage a high standard of scientific and technical attainment on the part of the staff, and promotion would go by merit; seniority was no longer regarded as the chief element for promotion in the Post Office. He was glad to relieve their minds of uneasiness, and hoped the transfer would take place with the minimum of disturbance to the staff and to the public service.

Mr. Ferranti, also responding, expressed regret at the passing away of that great commercial undertaking, which had been conducted like the early electric lighting undertakings, under conditions which greatly retarded the progress of industry. The difficulties met with by the company had absorbed the time and energies of the staff, which might otherwise have been directed to the expansion of the business. He regretted the transfer to the Government, as thereby the incentive to work for greater reward was largely lost. Why had they only half a million stations, while the U.S.A. had seven millions? Because in the latter the business had not had to be sacrificed for the benefit of the nation. Was it really for the nation's benefit? He only wished he could think so.

Mr. F. D. Watson proposed the health of "The Chairman," who briefly responded, and the proceedings then closed. An excellent musical entertainment was provided, in which Miss Mabel Manson, Miss Dorothy George, and Messrs. Peter Dawson and Nelson Jackson took part, Miss Poppy Adami being at the piano.

NOTES.

Electrical Fatalities.—The inquiry before Coroner Cadle into the circumstances attending the death of John McPherson, who was killed at Lumley Third Pit, near Leamside, Durham, on 13th ult., was concluded on May 27th. Mr. Nelson, Home Office expert, was present. The youth's father, at the opening of the inquest on May 16th, stated that his son had said the work was dangerous. He was in charge of the motor driving the coal conveyer. On the latter date the inquiry was adjourned for a post-mortem examination to be made. Dr. J. R. Hall, who had conducted the post-mortem examination, said the general appearance and condition showed death to be due to electric shock.

George Coulson, deputy overman, said that, on the morning of the accident, he got word that the machine required tightening up. He partly tightened it, and left a man named Watkins to finish it. When he got to the switch box, he found the motor "humming." He switched the current off at once, and went into the place where the motor was. There he found John McPherson on his left side, face downwards, lying in a little water between the sleepers and the rails. Previously to the accident both he and the fore-overman had experienced slight shocks. This was reported, and an electrician repaired the fault.

Mr. Harry Fisher, chief electrician for the Lambton Collieries, owners of the pit, said he had examined the motor sometime before the accident, and it was all right. He had never heard of anyone experiencing shocks previously to this accident. He made extensive tests of the machine afterwards, and found nothing to point to a cause for the accident. The tests were mainly to see if the machine were properly "earthed," and that there was continuity to bank. He found that was so. The accident might have been caused by an intermittent break in the earth circuit. The earth pin might not have been tightly screwed down. The earthing of portable machines like the motor in question was not compulsory under the regulations, but they had done it with the machines at these pits. Following the accident, they were doing away with terminal boxes, which the deceased might have touched, substituting automatic switches.

Matthew John Heron said that when at the "tumbler" end of the conveyor he experienced a shock. James Smith said that when he commenced tightening up he also got a shock. The men's inspectors reported that the affair was, in their opinion, a pure accident.

The jury found that the deceased met his death through an electric shock, and added as a rider that only experienced men should be employed in connection with electric machines. They were of opinion that no blame attached to the management.

It is reported from Canada that Mr. John Nuttall, night electrician of the Lakefield Mill of the Canada Cement Co. at Pointe aux Trembles, was recently killed while engaged in adjusting parts of a dynamo. When the body was found there were burns on the hands and wrists. Mr. Nuttall, who was 35 years of age, went to Canada 10 years ago, and for the past six months had been in the service of the Cement Co. He has left five children.

Tramcar Lifeguards.—The question of the efficacy of the tramway life guard was raised at an inquest held in Liverpool on Friday, May 26th, relative to the death of a little girl from injuries received through being knocked down by a Corporation tramcar. Mr. Mallins (general manager of the Corporation tramways) said there was a distance of about 2 in. between the bottom of the guard and the ground, and they could not get a guard that reached absolutely down to the ground. The Home Office had recently issued a return which showed that for the whole of the United Kingdom there was, during 1910, one fatality in every 20 million passengers carried, and for Liverpool one in every 25 million passengers, or 25 per cent. less than the average of the United Kingdom. By making a comparison with similarly thickly-populated districts, the number of fatal accidents in Liverpool in connection with tramways was remarkably small, as was shown by the fact that the number in Manchester last year was nine, Glasgow eight, Birmingham seven, and Liverpool two. As a practical man, he said that up to the present they had not been able to improve on the plough guard. He considered they had got the best guard possible, and the most efficient brakes.

Parliamentary.—*Electric Light Provisional Orders (No. 2) Bill.*—On May 23rd the above Bill came before the Examiner, and was ordered to be reported for second reading. The Bill confirms Provisional Orders granted by the Board of Trade in regard to the following districts:—

Macclesfield.—Order to the New Electricity Co. of Macclesfield, Ltd., Bank Buildings, Kingsway, London, in respect of the municipal borough of Macclesfield.

Pateley Bridge.—Order to Messrs. Christy Bros. & Co., of Chelmsford, in respect of the parishes of Bewerley and High and Low Bishopside, in the rural district of Pateley Bridge, in the West Riding of Yorks.

Portishead.—Order to Messrs. Christy Bros. & Co. in respect of the urban district of Portishead, and a number of surrounding parishes in the county of Somerset.

Rhondda.—Order to the Urban District Council.

Salisbury.—Order to the Salisbury Electric Light and Supply Co. to extend their area to include the parishes of Bemerton and West Harnham.

Wimbledon.—Order to the Corporation to include the Maldens and Coombe in the area of supply.

Witney.—Order to the U.D.C.

Third Reading.—In the House of Lords, on May 25th, the Metropolitan District Railway Bill was read a third time and passed, and in the House of Commons, on 24th ult., the London County Council (Tramways and Improvements) Bill, and the Metropolitan Electric Tramways Bill, were ordered for third reading.

Azores.—A correspondent in a recent letter says that in the Azores there are two power stations owned by Jono José Corduro. One is situated at Praia, Villa Franca, and the other at Riburagrande. Water power is used, the plant comprising turbines and transformers. During the day the various factories, &c., are supplied with electricity, but at night the power is employed exclusively for lighting purposes. The firm is known as Impresa d'Electricidade e Gaz, and is owned by the above-named. There is also an electric lighting supplier at Furnas. Messrs. Bensande and Co. work their own power and lighting plant for their sugar factory. There is in prospect a telephone exchange in the town of Ponta Delgada, which will be owned and worked by the Government.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—The annual report of the Council for the session 1910-11, which was adopted last Friday, shows that the total membership has risen from 6,218 to 6,370. One notes with regret the considerable number of well-known members who died during that period. During the session there were held 17 general meetings, one special general meeting and 21 council meetings; there have also been 50 meetings of local sections.

The Council has made the following scholarship and premium awards:—

Salomons Scholarships, value £50 each, to Richard Michael Clark, University College, and Edward M. Teare, Finsbury Technical College; David Hughes Scholarship, value £50, to Francis Lewes Otter, Central Technical College.

The Institution Premium, value £25, to Sir R. A. Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S., for their paper, "The Magnetic Properties of Iron and its Alloys in Intense Fields."

The Ayrton Premium, value £10, to Mr. H. T. Harrison, for his paper, "Street Lighting by Modern Electric Lamps."

The Fahie Premium, value £10, to Mr. Donald Murray, for his paper, "Practical Aspects of Printing Telegraphy."

The John Hopkinson Premium, value £10, to Messrs. A. P. M. Fleming and R. Johnson, for their paper, "Chemical Action in Windings of High-Voltage Machines."

The Paris Premium, value £10, to Mr. W. T. Taylor, for his paper, "Modern Long-Distance Transmission of Electrical Energy."

An Extra Premium, value £5, to Dr. E. Rosenberg, for his paper, "Control of Electric Winding and Hoisting Engines."

A Premium, value £5, to Mr. C. C. Hawkins, for his paper, "The Theory of the Static Balancer."

Students' Premiums have been awarded for papers by Messrs. G. W. P. Page and G. J. Scott, £10; Mr. Hugh C. May, £5; Mr. Allan Monkhouse, £5; Messrs. R. C. Plowman and E. F. Hetherington, £5; and Mr. A. R. Stelling, £5.

The report refers to the use of the Institution building during the past session, not only by the I.E.E. members, but by a number of allied engineering bodies.

An unofficial conference arranged by the Belgian Electrotechnical Committee was held in Brussels in August last, at which the British Committee were represented by Messrs. Siemens, Duddell, Edgcumbe, Hammond, O'Meara, Patchell and the Secretary of the Institution.

Reference is made to the revised wiring rules, and a draft revision of the model general conditions for contracts has been prepared. The Committee considering the use of electricity in textile mills has had several meetings, and another committee composed of representatives of the I.E.E., the Institution of Gas Engineers, the Institution of Municipal and County Engineers and the Illuminating Engineering Society has been formed to consider the preparation of a specification for street lighting.

Among other matters mentioned are the third Kelvin lecture which will be delivered next autumn by Dr. R. T. Glazebrook; the Council's decision to hold examinations of candidates for election and transfer to the associate member class, after January 1st, 1913; the publication of the *Journal* at shorter intervals; the holding of summer meetings, and the question of increasing subscription and entrance fees.

The report of the hon. treasurer shows that the balance carried to the General Fund at the end of 1910 was £3,053, as compared with £3,283 for 1909. The balance-sheet shows total assets amounting to £102,687, against which are liabilities amounting to £42,852; the amount comprising the net assets is almost entirely locked up in the acquisition of the lease of the Institution buildings, &c. The Building Fund stands at £92,289, and the increases of the various funds during the year total £3,979.

I.E.E. COUNCIL, 1911-12.—The nominees mentioned on page 681 were duly elected.

ROYAL SOCIETY OF ARTS.—On Tuesday last the annual conversazione of the Society was held at the Natural History Museum, South Kensington; Sir John C. Lamb and other members of the Council received the guests, and musical entertainments were provided by the band of the Royal Regiment of Artillery and by artistes under the direction of Mr. Patrick Kirwan, whose programmes also included dances, duologues, and other miscellaneous features. A large and brilliant company attended, and the function proved in every way successful.

CONCRETE INSTITUTE.—The Summer Meeting of the Institute will be held on June 7th and 8th, in London, and the first annual dinner will take place on the former date, followed by a conversazione next day. Papers will be read and discussed, and visits to important buildings have been arranged.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS (EAST OF SCOTLAND BRANCH).—At a meeting of the Branch on Friday last at Dunfermline, Mr. C. Augustus Carlow, Fife Coal Co., was elected president for the ensuing session; the vice-president is Mr. H. Gordon Fraser, Fife Coal Co.; and the hon. secretary, Mr. Thomas Davidson, 16, Rutland Square, Edinburgh. With a view to stimulating interest in the branch, the meeting discussed the propriety of holding meetings in such districts as Wemyss, Alloa and Polmaise.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—The following are among the arrangements included in the programme for the Edinburgh meeting (July 13th and 14th):—"Transfer Fares," by Mr. C. W. Shepherd, general manager, Edinburgh tramways; "A few Reasons why Electric Traction in England Remains Stationary," by Mr. G. H. J. Hooghwinkel; "Notes on Tramway Problems," by Mr. C. W. Mallins, Liverpool; "Tramways and Light Railways Legislation of the Future," by Alderman W. Ivey, of West Ham. All the papers will be published in the Association *Journal* a week before the Congress.

SOCIETY OF ENGINEERS.—The second annual dinner of the Society was held on Saturday; Mr. F. G. Bloyd (president) occupied the chair, and was supported by many distinguished engineers.

Appointments Vacant.—Several electrical fitters (36s.) are wanted for ship installations at Devonport Dockyard; shift engineer for the York Corporation electricity department (£91); shift engineer for the Stockton-on-Tees Electricity Department (28s. 6d.). See our advertisement pages in this issue.

Will.—Mr. J. G. H. Glass, a director of the Calcutta Electric Supply Corporation, Ltd., who died in April, left gross estate £216,885, with net personalty £216,691.

Inquiry.—A correspondent asks for particulars of a process for seasoning wood by electricity.

Electrical Trades Benevolent Institution.—The following is a further list of donations and subscriptions received by the hon. secretary, Mr. F. B. O. Hawes, of Balfour House, Finsbury Pavement, E.C.

	Subscriptions.	Donations.
Crompton & Co., Ltd.		£5 0 0
Lawton, John, & Sons	£1 0 0	
Lundberg, A. P., & Sons	2 2 0	
Shield, W. S.	1 1 0	
General Accessories Co., Ltd.	1 1 0	
Bourne, J., & Son		1 1 0
Clarke, Forde & Taylor		3 3 0
Davidson & Co., Ltd.	1 1 0	
Chard, F.	0 10 6	
Ormiston, P., & Sons		3 3 0
Graham, Alfred, & Co.		3 3 0
Wilson, C.	0 10 6	
Wiggins, F., & Sons		1 1 0
Benson, W. A. B., & Co., Ltd.	0 10 6	
Butler, H. W.	1 0 0	
May, H. J.		1 1 0
Cerson, J.		1 1 0
Clarke, E., & Co.	1 1 0	
Johnson, Matthey & Co., Ltd.		10 10 0
Swinton, A. A. Campbell		1 1 0
Electrical Press, Ltd. ("Electrical Industries")	2 2 0	
Murray, Lee		2 2 0

Consular Information.—In Tuesday's Parliamentary Papers Mr. Houston asks the Foreign Secretary to describe the existing practice by which information concerning British trade and shipping is received and distributed in this country, and suggests that in view of German and American competition instructions should be given to British Ministers and Consuls to take a keener interest in these matters. Sir Edward Grey replies as follows: His Majesty's Consular officers communicate directly with the Commercial Intelligence Branch of the Board of Trade with regard to questions addressed to them by the Branch, and furnish the Branch with information as to contracts open to tender (by telegram, where that course appears desirable), and also as to classified lists of the principal dealers in various kinds of goods within their Consular districts. Answers to questions addressed to Consular officers by British firms are transmitted through the Commercial Intelligence Branch. The Consular officers also communicate directly with the Marine Department of the Board of Trade on matters arising out of the Merchant Shipping Acts. In all other cases His Majesty's Consular officers report to the Secretary of State, as do His Majesty's Ministers abroad in all cases. Copies of these reports, so far as they relate to subjects dealt with by the Board of Trade, are forwarded immediately to that department. The information so received by the Board of Trade, when likely to be of interest to British merchants, manufacturers or shipowners, is either published in the weekly Board of Trade Journal or communicated to firms on the Special Register of the Commercial Intelligence Branch or sent to Chambers of Commerce and other interested bodies. Samples of materials for industry or of goods competing with British products supplied by Consular officers from time to time are displayed at the offices of the Commercial Intelligence Branch. The annual reports of His Majesty's Consular officers are edited by the Foreign Office and the Board of Trade jointly, and the Board consult with the Secretary of State as occasion requires respecting any changes which may seem desirable in the Consular Instructions, so far as they relate to commerce and navigation. Newly appointed Consular officers are required to spend some time at the Commercial Intelligence Branch of the Board of Trade before taking up their appointments, with a view to their becoming acquainted with the general nature of the requirements of British traders in the matter of the supply of commercial information. German diplomatic and Consular officers report on matters relating to trade and shipping direct to the commercial department of the Imperial Foreign Office and receive their instructions from the same source.

Electric Lamp for Miners.—The Home Secretary has announced that a colliery proprietor has placed at his disposal a sum of £1,000 as a prize for the best lamp fulfilling the requirements given below. Mr. C. Rhodes (Past President of the Institution of Mining Engineers) and Mr. C. H. Merz (a member of the Departmental Committee on the Use of Electricity in Mines) have consented to act as judges.

The conditions of the competition are as follows:—

1. The competition will be open to persons of any nationality.

2. It will be in the discretion of the judges to award the whole of the prize for the lamp which they consider to be the best; or to divide the prize; or to make no award, if no lamp appears to them to be of sufficient merit.

3. Lamps must be addressed care of C. Rhodes, Esq., at the Home Office Testing Station, Rotherham, and must reach the testing station not later than December 31st next; a spare globe should accompany each lamp.

The requirements which should be fulfilled by any lamps submitted for competition are as follows:—

1. The lamp should be of sound mechanical construction so as to withstand rough usage.

2. The lamp should be of simple construction and easy to maintain in good order and repair.

3. The lamp should be so constructed as to render impossible the ignition of inflammable gas either within or without the lamp.

4. The lamp battery should be so constructed that any liquid which it may contain cannot be spilled when the lamp is in use, and means should be provided for dealing with any gas which may be generated by the battery.

5. The materials used and the construction should be such that metals and other parts will not be liable to deterioration by corro-

sion as a result of the action of the electrolyte, &c., used in the battery.

6. The lamp should be effectively locked so that it cannot be opened without detection.

7. The lamp should be capable of giving an amount of light not less than 2 C.P. continuously for a period of not less than 10 hours.

8. The light should be well distributed outside the lamp. A movable reflector to concentrate or to shield the light may be provided.

In addition to the above requirements, regard will be paid to (*a*) the first cost of the lamp; (*b*) the cost of maintenance; (*c*) convenience in handling; and (*d*) the weight of the lamp when charged and ready for use.

Hulton Colliery Explosion.—The report of the Chief Inspector of Mines, just issued, states that the author, Mr. R. A. S. Redmayne, has come to the conclusion that a quantity of gas was ignited by a safety lamp being overheated, falling, or being damaged by a fall of stone. He feels that the question of displacing the oil lamp with electric lamps deserves the most serious consideration of mining engineers; this remark is of interest in connection with the offer of a prize for the best electric lamp mentioned above. Mr. Redmayne found that the electrical plant was strong, properly erected, and well maintained. Further reference to the report must be deferred to our next issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. EGERTON J. WARD, A.M.I.E.E., has resigned his position as senior engineer-in-charge at the Eccles Corporation electricity works in order to take up a post with the Para Electric Railways and Lighting Co., Ltd. MR. C. W. MARSLAND takes up the position of senior engineer-in-charge vacated by Mr. Ward.

MR. G. C. CHAMBERLAIN, of Reigate, has been appointed junior shift engineer at Croydon.

The Grays U.D.C. on May 25th rejected, by six votes to four, a recommendation that the salary of MR. E. D. LONG, electrical engineer, should be increased by £10 per year. Some members voted against the recommendation on the ground that the increase was not sufficient, and it is understood that the matter will again come up at the next meeting.

MR. J. G. MCLEAN has resigned the position of engineer and manager to the Woking Electric Supply Co., Ltd., which he has held for over 10 years. His connection with the company has extended over 14 years. Future communications should be addressed to him at Dunblane, Woking, Surrey.

MR. G. TOUGH, electrical engineer and manager of the electricity department of the Coventry Corporation, was unanimously granted an increase of salary from £450 to £550 per annum at the meeting of the Council on May 30th.

MR. R. K. BUTLER, shift engineer at Hounslow, has resigned, to take an appointment with the Underground Electric Railways. MR. JEFFREY BLAKE, an improver at the works, has been appointed to the vacancy.

MR. RICHARD A. GOLDING, A.M.I.E.E., assistant electrical engineer to the Borough of Ealing, W., has resigned his appointment, and is sailing for Australia by the ss. *Suevic* on July 1st.

The appointment of borough electrical and tramways engineer came before the Lancaster Council on Wednesday. The appointment of MR. GEO. C. MILNES, who has been carrying out the duties on probation during the last six months, was unanimously confirmed, and the engineer's salary is to be further increased by £50 per annum for the next 12 months.

Tramway Officials.—On Sunday morning, 28th ult., at the Luton Tramway depôt, MR. G. W. JOHNSON, the manager, who is leaving to take up a similar position in South Wales, was presented with a smoking cabinet and an enlarged photograph of the staff and employés.

General.—MR. F. MONKHOUSE, for seven years assistant manager to Arc Lamps, Ltd., has terminated his connection with the firm. His present address is 17, Blandford Road, St. Albans.

MR. FRANCIS MCLAREN, M.P., has been elected a director of the Metropolitan Railway Co., in place of Sir W. Birt, whose death was recently announced.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Alderley and Wilmslow Electric Supply, Ltd. (47,663).—A statement of the total amount outstanding on July 1st, 1908, in respect o mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Trust deed, dated 1900, securing £18,000, of which £5,000 had been issued before July 1st, 1908.

Escare & Denelle, Ltd.—Particulars of £6,000 debenture stock, created April 14th, 1911, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,900. Property charged: Leasehold premises, 129, Wardour Street, Ham Yard, Westminster, and the company's undertaking and property, present and future, including uncalled capital. Trustees: R. T. Smith, Rayners Lodge, Putney; and H. Samson, Morningside, Hastings.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

THE directors' report for 1910, to be submitted to the meeting on June 7th, shows a gross profit of £28,200, but after debiting general charges and maintenance, together with debenture and other interest, there is an adverse balance of £10,800. The *Financial Times* quotes the report thus:—"The company has carried out during the past year many important contracts, including turbo-generators, large steam dynamos, electrical machinery and apparatus generally, as well as other tramway and railway rolling stock, and although the accounts for 1910 again show a loss, there is, nevertheless, a substantial improvement as compared with the two previous years. The directors hope for a continued further improvement, as there are indications of increased activity in many of the home industries. The prospects of the export business are also more encouraging. The volume of orders received during the opening months of 1911 has been above the average, but prices remain low, and are not likely to improve until competition becomes less keen. The amount now standing to the debit of profit and loss account in the balance-sheet—namely, £61,100—and the fact that depreciation not yet provided for has taken place in certain of the company's investments, point to the necessity of an early reorganisation of the share capital in order that profits, when earned, may be distributed. This is a matter to which the directors are giving their careful attention."

Anglo-Portuguese Telephone Co., Ltd.

THE twenty-fourth annual general meeting of the Anglo-Portuguese Telephone Co., Ltd., was held on Monday, at 48, Cannon Street, E.C., Mr. Herbert Allen presiding.

The CHAIRMAN, in moving the adoption of the report, said he was sorry their shareholders did not turn up in larger numbers at their meetings. But he could hardly wonder at it, as each one of their meetings was very like another. Their progress was almost monotonous in its steadiness: they paid the shareholders year after year a fair return on their money, and simultaneously they added to their reserve capital at an ever-increasing ratio. He thought that this was the fourth time in succession that they had paid 8 per cent. dividend on their share capital. He did not want them to think that the company regarded 8 per cent. as a maximum, but wtlh a closed capital account and a very progressive business—as theirs was—and having regard to the general position of affairs in Portugal, it behoved them to keep their eye on their cash resources. Looking back over a period of 10 years, he found that their gross income had increased from £19,223 to £54,391. Their gross profit in the same 10 years had increased from £4,967 to £21,614, and their net profit in the 10 years had increased from £3,519 to £17,330. In the meantime they had materially increased their capital expenditure, but taking only the past five years, during which time the subscribed capital had undergone no change whatever, their progress had been quite satisfactory—not so rapid as for the period of 10 years, but still quite satisfactory. For example, since 1905 their gross income had increased from £29,808 to £54,291. Their gross profit had grown from £12,284 to £21,614, and their net profit from £9,702 to £17,330. In other words, their income in the last 10 years had increased the best part of 200 per cent., and the profit nearly 500 per cent., whilst in the past five years their income had increased about 80 per cent., and their profit about the same. He had no doubt that if they were given a little more lattitude under their concession in the management of their business in Portugal, they could do better, not only for themselves, but for their customers, the telephone-using public out there. Of course, it must not be assumed that the percentage of increase which he had just mentioned was going to continue indefinitely. In the ordinary course the actual figures of income and profit would continue to expand, but the percentage of increase would, if anything, have a tendency to diminish. With regard to the events of the past year, he would say nothing beyond a word about the labour situation in Portugal. They had been threatened, in common with other employers of labour in Portugal, with one or two strikes. At Oporto in particular it looked at one time as if they would have rather serious trouble. Thanks, however, to the courageous and firm handling of the situation by their local manager, Mr. Street, the strike was effectually stamped out, and their business in Oporto was now working quite normally. At Lisbon they had been rather more fortunate than some other employers of labour in that city. As a matter of fact, their employés were all well paid and well cared for, and when left alone were contented. But, unfortunately, in these days of the professional agitator that went for very little. They did their best, but the agitator did his worst, and the result was, capital lost a little and labour lost more. What the current year

had in store for them in this respect he did not know, but he had no doubt that if they were threatened with labour troubles they would be equal to the occasion. The shareholders would see on reference to the accounts that they were carrying a much larger sum to reserve than they had done in any previous year (£10,000 as against £7,500), and the reserve fund now amounted to a total of £37,500. In order to carry to reserve that additional £2,500 they had carried forward about £500 less.

Mr. J. E. Kingsbury seconded the motion.

Mr. Hibbert, while congratulating the directors upon the success which had attended the operations of the company, said he thought the shareholders might have had a little larger dividend. With regard to the amount placed to reserve, that could hardly be called a reserve fund, seeing the money was spent in the business.

The Chairman said that, by placing a large sum to reserve, the necessity of providing further capital was avoided. It seemed a large sum to put to reserve every year, but he was confident that, in the long run, it would be found to be the soundest policy. It must be remembered that their concession did not run for ever, and therefore they did not desire to have an increased capital standing against a diminished period of their concession. Personally, in the case of a telephone company, he considered that capital put into the business in the way they were doing was a good reserve, and it paid the company very well.

The report was adopted.

Callender's Cable and Construction Co., Ltd.

The directors' report for the year ending December 31st, 1910, shows a balance at the credit of profit and loss account of £55,839 plus £42,202 brought forward, making together £98,041. From this must be deducted interest on debenture stock, £13,500; dividend on preference shares, £10.000; appropriation for depreciation of buildings, plant and machinery, £8,218, making together £31,718, leaving an available balance of £66,323, which it is proposed to deal with in the following manner:—dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, being 10s. per share, whereof 5s. less income-tax was paid on November 1st, 1910, and 5s., less income-tax, will be paid on June 10th, 1911, £17,500; a bonus of 5s. per share, less income-tax, to be paid also on June 10th, 1911, £8,750, carrying forward £40,073. The profit realised for 1910 is somewhat in excess of that of the previous year, although the conditions which prevailed in the cable industry were practically identical in both periods, no material improvement in the business having occurred during 1910. The increase in trade, of which there were many indications in the early part of last year, was not maintained, and the year was characterised by an absence of new enterprises. In the early part of this year, there were again distinct evidences of a coming improvement in the electrical industry generally, but this, following the course of so many other trades in this country, seems for the present to have disappeared. On the other hand, the use of electrical energy for power purposes has recently been largely extended in many parts of the United Kingdom, with most beneficial results to the power companies, which are, almost without exception, now making excellent progress. This is satisfactory to this company, not only in respect of the larger amount of cable orders anticipated, but in regard to the financial standing of the power companies in which the company are interested, which has materially improved owing to the steady increase in the use of electricity. Every effort has been made to widen the company's over-seas relations, and considerable contracts have been secured in various colonies, this company's operations in South Africa having been specially developed. Important orders have also been received from the Continent, and no opportunity has been neglected of still further extending the sphere of this company's operations. The business of the Anchor Cable Co., Ltd., in house wires and rubber cables, has again been highly satisfactory, and substantial profits have resulted, which are in excess of those of the previous year. These profits have been secured in spite of the serious disorganisation of the insulated wire trade resulting from the recent violent fluctuations in the price of rubber. Owing to the conservative policy adopted, the Anchor Co. suffered no loss from the wide variations which prevailed in the prices of raw materials. The business in house wires and rubber cables carried on at Leigh, is being vigorously pushed, and shows considerable expansion, especially in the Colonies. As usual, all machinery, plant, and appliances at the factories, and on outside contracts at home and abroad, have been maintained in the highest possible state of efficiency, the cost of which has been debited against the year's profits. New machinery has been put down both at Erith and at Leigh, in view of the approaching acquisition of the telephone system of this country by the Government, and further extensions in this direction are in hand. Attention is called to the item appearing in the accounts for the first time under the heading of the Uxbridge and District Electric Supply Co., Ltd. Circumstances arose during the past year, which, in the opinion of the directors, rendered it good policy for the company to acquire this undertaking, and in due course it passed into this company's hands involving a considerable expenditure of capital. The necessary funds were obtained from the company's bankers by a special loan against this transaction. Since the close of the year, an issue of debenture stock in the Uxbridge Co. has been made, by which the expenditure incurred by this company will be reimbursed. This item, therefore, will not appear in the next statement of the accounts. The directors believe that the step they have taken in regard to the Uxbridge Co. will result in a considerable and profitable business. The report refers to the sudden death of Mr. H. E. Harrison, who had been for nine years its secretary, and adds that Mr. Petersen, the assistant-manager, has been appointed acting-secretary to fill this vacancy for the present. They also express regret at the death of Mr. David Painter McEuen, who was one of the original founders of the company, and until a few years ago, a member of its board. The balance at credit of profit and loss account for 1909 was £54,362, and the available balance £68,452. The dividend and bonus were the same.

Leamington and Warwick Electrical Co., Ltd.

The directors' report presented at the thirty-first ordinary general meeting, stated that during the past year £2,447 had been expended on capital account, and the total capital expenditure amounted to £109,630. With regard to the profit and loss account, the working accounts showed a credit balance of £4,612 from the tramways and electricity supply, and interest and sundry receipts amounted to £166. After deducting the general expenses, amounting to £1,298, interest on debentures, and £350 provision for renewals, there remained a balance of £1,555, plus £119 brought forward, making a total amount available for distribution of £1,674, which the directors recommend should be applied as follows:—To reserve account, £750; dividend of 5 per cent. on the cumulative preference shares for the year, £120; dividend at the rate of 1 per cent. on the ordinary shares for the year, £676, carrying forward £128. Before arriving at the profit, the directors had debited the profit and loss account with £350, which had been placed to renewals account. This account now stands at £1,400. The traffic receipts increased by £46 as compared with 1909. The supply of electricity has progressed during the year, and the number of installations connected at December was 276, exclusive of the tramway load, and is equivalent to 9,943 8-c.p. lamps, compared with 7,870 8-c.p. lamps at December, 1909. The gross revenue from the sale of current, &c., was £3C0, compared with £2,705, a satisfactory increase. Efforts were being made to secure several large installations, which would prove remunerative to the company.

Uxbridge and District Electric Supply Co., Ltd.

An extraordinary meeting of the shareholders of the Uxbridge and District Electric Supply Co., Ltd., was held at the offices of the Board of Trade, Carey Street, W.C., on May 23rd, before Mr. Burgess, Assistant Official Receiver.

The Chairman stated that the meeting had been called for the purpose of confirming a resolution proposed some fortnight ago for the purpose of converting the ordinary £5 shares into £1 shares. The resolution was as follows: "That the existing 10,000 ordinary shares of £5 each be sub-divided into 50,000 shares of £1 each, Nos. 1 to 50,000." That was being done for the purpose of more easily carrying out a scheme for the reconstruction and rearrangement of the company. He did not think it was within the functions of the Official Receiver to preside at that meeting, it being merely a formal one. It was then resolved that Mr. Thomas, one of the shareholders, should occupy the chair, and the resolution was formally put to the meeting and carried unanimously. It was also resolved unanimously that: "Mr. Charles Henry McEuen, Mr. Theodor Petersen, and Mr. James Ormiston Callender be and they are hereby appointed directors of the company, and shall constitute the new board of directors of the company."

In putting the resolution to the meeting, Mr. Lovibond said they were all very glad—at all events, the small shareholders at Uxbridge were—to learn that they were going to get something in the new company; although their shares were to be reduced by one-fifth, he hoped the shares would go up in value, so that they would not be anything out of pocket. He also hoped the company would have a future brighter than its past had been. It was then resolved unanimously "That the directors be and they are hereby authorised to increase the capital of the company to 100,000 shares by the issue of 25,000 new ordinary shares of £1 each." A vote of thanks to Mr. Thomas for presiding, brought the meeting to a close.

The debenture stock prospectus has this week been before the public.

Birmingham and Midland Tramways, Ltd.—The directors report that the total revenue for the year 1910 from all sources was £102,618, compared with £99,713 for the preceding year. The expenses amounted to £53,703, compared with £48,710 for 1909. After providing for all expenses chargeable to revenue, including repairs, maintenance, sums payable to corporations, and placing £3,000 to renewals account, there remains (says the *Financial News*) £45,915, plus £149 brought forward, making £46,064. From this, interest on loans takes £6,812; interest on debenture stock, £15,178; leaving £24,072. After deducting for debenture sinking fund £4,228; for dividend for the year on the 5½ per cent. preference shares, £11,537; there remains £8,306. The directors recommend a dividend on the preferred ordinary shares at the rate of 2 per cent. for the year ended December 31st, 1910, £7,000; depreciation and reserve account, £1,000; carrying to the next account, £306. The gross receipts from the tramways were £48,025, compared with £46,477 in 1909. The gross receipts from the lighting and power departments amounted to £26,737, an increase of £6,942 over the previous year. The dividends received from investments produced £25,177 compared with £27,228 in 1909. The difference is due to the shares held by the company in the Dudley, Stourbridge and District Electric Traction Co. being less remunerative in the year under review, owing to decreased traffic receipts

and the increased cost of permanent way and other repairs. The total expenditure on capital account during the year was £31,017, of which £444 was spent upon the tramway undertaking and £30,573 upon the lighting undertaking in respect of the 2,000 KW. set installed during the year, the accessory plant, and the extensions of the buildings. In accordance with the trust deed, a sum equal to 1 per cent. on the debenture stock issued, together with interest on the stock purchased and cancelled, was paid to the trustees in July last, and was applied by them in the purchase and cancellation of £5,230 of stock. The total amount of debenture stock now outstanding is £334,696. The company holds 39,923 preference shares and 43,156 ordinary shares of £1 each, fully paid, in the Birmingham and Midland Motor Omnibus Co., and in consequence of the uncertain value of this investment the directors have written the holding down to a small figure.

Companies Struck off the Register.—The following companies will, unless cause be shown to the contrary, be struck off the register and accordingly dissolved :—

Amalgamated Dry Batteries, Ltd.
Durolite, Ltd.
Edison Gower-Bell Telephone Co. of Europe, Ltd.
Elmore's American and Canadian Patent Copper Depositing Co., Ltd.
Elmore's Foreign and Colonial Patent Copper Depositing Co., Ltd.
Elmore's Patent Copper Depositing Co., Ltd.
Elmore's Wire Manufacturing Co., Ltd.
Premier Boiler Tubes, Ltd.
South-Western Electrical Co., Ltd.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to :—

Central London Railway Co.—Scrip fully and partly (50 per cent.) paid, for £385,000 4½ per cent. preference stock.

And to allow the following securities to be quoted in the Official List :—

Bell's United Asbestos Co., Ltd.—Further issue of 19,373 shares of £1 each fully paid.
Havana Electric Railway Co.—$1,847,000 additional consolidated mortgage 5 per cent. 50-year coupon bonds of 1952 of $1,000 each, Nos. 8,154 to 10,000.
Montreal Water and Power Co.—Further issue of £27,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 7,226 to 7,495.
Rhondda Tramways Co., Ltd.—Scrip, partly paid, for £200,000 5 per cent. first mortgage debentures.

The Committee has appointed a special settling day as under :—

Thursday, June 15th.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £600,000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B17,501 to 23,500.

And ordered the undermentioned securities to be quoted in the Official List :—

County of London Electric Supply Co., Ltd.—Further issue of £50,000 4½ per cent. debenture stock.
Havana Electric Railway Co.—$1,847,000 additional consolidated mortgage 5 per cent. 50-year coupon bonds of 1952 of $1,000 each, Nos. 8,154 to 10,000.
Montreal Water and Power Co.—Further issue of £27,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 7,226 to 7,495.
Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £600,000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B17,501 to 23,500.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a final dividend of 6s. per share on the ordinary shares.

Western Telegraph Co., Ltd.—Third quarterly interim dividend, 3s. per share, free of income-tax, for the year ending June 30th, 1911, being at the rate of 6 per cent. per annum. The transfer books will be closed from 14th to 20th inst., and the dividend will be payable on 21st inst.

R. Hornsby & Sons, Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (less income-tax) on the preference stock for the half-year to March 31st.

Prospectuses.—*Consolidated Gas, Electric Light and Power Co., of Baltimore.*—The London Joint Stock Bank, Ltd., has been offering, on behalf of the contractors, $1,000,000 general mortgage 4½ per cent. 30-year gold bonds of this company, at 89 per cent.

Adelaide Electric Supply Co., Ltd.—A prospectus has been filed inviting applications for £100,000 5 per cent. debenture stock at par.

Mackay Companies.—The regular quarterly dividends of 1 per cent. on the preferred shares, and 1¼ per cent. on the common shares, are announced.

Lima Light, Power and Tramways Co.—The directors' report states that the profit and loss account for 1910 shows the following results :—Total profits obtained, £p.166,701 ; less bond service, £p.40,233 ; interest and discount, £p.41,609 ; exchange, £p.1,596 ; leaving a net profit of £p.83,262 ; which the board has divided as follows :—To reserve fund, £p.4,163 ; to directors and managers, £p.7,929 ; shareholders, £p.68,062 ; leaving a balance of £p 3,107, which it is proposed to pass to the reserve and redemption fund.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended March 31st were 801,705, compared with 743,651 units in the corresponding five weeks of 1910 ; and for the four weeks ended April 26th, 787,233, compared with 780,512 in 1910.

Belgian Electrical Companies.

THE Société Générale Belge d'Entreprises Electriques, of Brussels, which is partly an investment company and partly owns electrical undertakings, realised gross profits of £61,000 in 1910, as compared with £49,000 in the previous 12 months. After meeting interest charges and management expenses, the accounts show net profits of £41,000, as against £33,000 in 1909. A dividend at the rate of 8½ per cent. has been declared on the ordinary capital, being the same as in the preceding year. The share capital amounts to £400,000, as against £320,000 in 1909, and the loan capital reaches £192,000, as contrasted with £155,000 a year ago.

The directors of the A.E.G. Union Electrique, of Brussels, state, in their report for 1910, that the company had a larger turnover, and the orders on hand in April, 1911, were materially greater than a year previously. The increase applied to all departments, and the directors declared themselves satisfied with the working of the provincial branches. As net profits the accounts indicate the sum of £15,000 for 1910 on an ordinary share capital of £140,000, and a dividend of 6·7 per cent. has been declared, or the same rate as in 1909. At the recent meeting the directors were authorised to acquire the whole of the capital of the Société d'Electricité Lahmeyer, amounting to £40,000, upon which one-fourth has been paid.

The Ateliers de Constructions Electriques de Charleroi report having had a turnover of £480,000 in 1910, as contrasted with £338,000 in the preceding year, and the orders received in the early months of 1911 showed an increase over those in the corresponding period in last year. A further development took place in the company's coal mining department, which obtained many orders for winding engines, turbo-alternators, centrifugal pumps and various motors. As a result of various competitions, the company had been entrusted with the construction of electric cranes for the ports of Ostend, Ghent and Brussels. The workshops built on the site of the Villette were brought successfully into use in 1910, and it had, therefore, been possible to relieve the Philippeville works in the construction of large machines. In addition to the provision of an iron and brass foundry, the company began the establishment of a cable factory in June, 1910, such a factory not having previously existed in Belgium, at all events, for armoured cables. The factory was brought into operation in February, 1911. A copper-drawing mill was being provided in connection with the cable factory, together with plant for the manufacture of tubes and insulating material. As a result of these various developments, the Charleroi works would represent a complete and self-contained undertaking which was comparable to the large similar enterprises in other countries. The accounts exhibit net profits of £31,000 for 1910, and dividends have been declared of 28s. on the fully paid-up priority shares, 10s. on the priority shares, upon which 10 per cent. has been paid, and 8s. per share on the ordinary capital.

Potteries Electric Traction Co., Ltd.

THE thirteenth ordinary general meeting of the shareholders of the above company was held on Monday at the Electrical Federation Offices, Kingsway, Mr. G. F. M. Cornwallis-West presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 850), said the net result of the year was that they had increased their profit by £164, as compared with 1909. The traffic receipts showed an increase of £418 ; parcels, £250 ; advertising, £23 ; and sundry receipts, £451. Interest on shares and debentures showed an increase of £1,156, which was due to the declaration of a bonus of 2s. per share on the ordinary shares of the North Staffordshire Tramways Co. They held all the debentures, and 90 per cent. of the shares in that company. The total increase in receipts, therefore, was £2.298. They carried 424,162 fewer passengers in the year, but they had received a slightly higher fare per passenger, the figures being 1·24d., as against 1·20d. The reason for the decrease in the passengers carried was the continued trade depression in the Potteries district, but he was glad to say that business was improving. As he foreshadowed at the last meeting, at the beginning of last year they introduced ½d. fares on the fair fare system. They were not a success either from the public point of view or for the company. The farthings were not understood, and they had, therefore, got rid of them, and had substituted ½d. stages with a minimum fare of 1d., and the result so far had been very satisfactory. Turning to the expenditure, the power, running and parcels expenses showed a small increase of £69, in spite of the increased service that had been run ; they having run 29,800 more miles than in 1909. Repairs and maintenance showed an increase of £1,690, £1,000 of which was accounted for by increased expenditure on the permanent way, which was charged to profit and loss account. Of course, that would be an increasing expense, for the older the rolling stock and the permanent way were, the more money they would have to spend to keep them in repair, but he thought the whole was now in a very satisfactory condition. He did not mean by that to suggest that they were not going to spend as much, or probably more, in that way in the years to come. The administration and general expenses had increased from £7,238 to £7,938, of which £400 was due to an increase in rates, £245 to increase in directors' fees, and £286 in office, travelling and general expenses : the increase in the latter case being mainly incurred in obtaining the abandonment of the order for the extensions into outlying districts. That was a very important matter, as if they had been called upon by the Board of Trade to construct certain outlying lines to which they were committed by their order, it would have landed the company in very serious loss. £5,310 had been taken from the reserve account, which was due to the fact that they had received several letters from shareholders and debenture-holders pointing out that although

that sum appeared as an asset it was not really so, as it was commission paid to underwriters when they borrowed money on debentures. The board had, therefore, come to the conclusion that the best way to deal with the matter was to write it off and take it out of the reserve fund. £1,784 had been expended during the year on capital account, £1,611 of which had been spent on improvements and additions to the permanent way. On renewals account £7,090 had been appropriated from the 1909 profits, and £4,025 was spent during 1910 on renewals, which left a credit balance of £1,474 on that account, compared with a debit balance of £1,590 in the last account. This year they proposed to add £7,525, which would give the fund a considerable credit balance. To sum up, they had £27,384 to deal with as compared with £27,290 last year. They proposed to add £2,302 10s. to the depreciation reserve account, as against £2,000 last year, and £7,525 to the renewals account, and pay a dividend of 5 per cent. on the preference shares, and 2 per cent., as last year, on the ordinary. He was very pleased to say that for the first four months this year the company had done much better than in the corresponding period last year. As a matter of fact, the receipts up to April 28th had increased by £4,602, while the expenses had only increased by £219. Of course they would have to spend money on improving the permanent way, but still, so far as one could judge, the results this year should be a considerable improvement upon those of 1910.

LIEUT.-COL. SIR T. PILKINGTON, Bt., seconded the motion, and the report was adopted.

Paris Metropolitan Railway Co.

THE report for 1910 of the Compagnie du Chemin de Fer Metropolitain de Paris refers at length, as in former years, to the works carried out by the City of Paris and by the company during the 12 months, and to those in progress and preparation. Apart from the partial interruption in the traffic through the inundations in January, the average length of line in operation was 38½ miles, whilst the opening of two new sections since January, 1911, has raised the mileage to 43¾. The net average yield per mile of track declined considerably as compared with the preceding year, owing to the disturbance caused by the floods, and the reduction in the receipts from this cause was estimated at £160,000 at the least. The accounts exhibit the following figures for the two years :—

	1910.	1909.
Share capital	£3,000,000	£3,000,000
Bond capital	3,200,000	3,000,000
Total receipts	1,789,000	1,793,000
Working expenses	766,000	755,000
City share in receipts ...	580,000	586,000
Net profits	294,000	332,000
Dividend	235,000	236,000
„ per cent.	8	8
No. of passengers carried ...	251,701,000	254,445,000

The number of employés and agents of all grades in the company's different services advanced from 4,446 at the end of 1909 to 5,023 on December 31st, 1910, and the system of paying bonuses, which entrusted the various classes concerned with the proper management of the railway, was further developed. The bonuses amounted to £25,300 in 1910, or £1,900 in excess of the previous year. In addition, the company continued the policy of encouraging the erection of workmen's dwellings for the accommodation of the employés.

Lisbon Electric Tramways, Ltd.

THE meeting of this company was held on Wednesday last week, at the offices, 1, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 812), after referring with regret to the death of Col. Sir Charles Euan Smith, who had been chairman of the company since its formation, said the accounts showed that the company had more than maintained its position during the past year, having carried 49,925,167 passengers and earned £328,599, as against 47,995,076 passengers and £301,426 in receipts for the previous year. The net profit for 1910 had amounted to £132,980, as compared with £129,351 in 1909. The figures for last year would have been considerably increased but for the revolution which broke out in Lisbon in October, which disorganised the business life of the city, and, in fact, the tramway operations were entirely suspended for three days, and some considerable time elapsed before the entire traffic on all the lines was completely re-established. At the request of their colleagues he and Mr. Rommel, the managing director, proceeded to Lisbon immediately after the overthrow of the Monarchy, where their presence was urgently required owing to the changed conditions and the spirit of unrest which, unfortunately, had broken out among all classes. They remained there some time, interviewing a number of the officials of the Provisional Government and the municipality, and giving counsel and support to the general manager and the members of the local board in their efforts to persuade their men to remain at work. The general spirit of unrest, however, induced the men to make demands, many of which were quite unjustifiable. They carefully considered all complaints, and made many concessions, but all their efforts failed to avert a strike which took place after they had returned to London. Under the very peculiar circumstances prevailing, the directors thought the wisest policy to adopt was to request the good offices of some neutral party, and Senor Almeida, the Minister of the Interior, consented to act as arbitrator. By the arbitration they were enabled to put an end to the strike, but the company was obliged to make great sacrifices as regarded reduction of working hours, increase of wages, and the granting of holidays with pay. As a consequence, their operating expenses would be considerably increased, whilst they could hardly expect for some little time to come that the rate of expansion of traffic would be resumed on the same scale as before the revolution. The board had, therefore, deemed it prudent to limit the final dividend to 2½ per cent., making a total of 5½ per cent. for the year, and to defer the intended increase to 6 per cent. until general conditions had assumed normal proportions. He was glad to have that opportunity of testifying to the general law-abiding character of the Lisbon population. The city had come through a tremendous political revolution with very little loss of life, and an exceptional respect for the rights of private property was observed. Their tramways had sustained no damage at all, and no loss had been incurred except the suspension of traffic. He considered that a striking testimony to the good order and self-control of the Lisbon population. The tramways were now in full working order; the equipments, rolling stock, permanent way, &c., were in excellent condition, and the employés had lately shown a spirit of loyalty, when a general strike of workers was attempted, which proved that the concessions they had given them had not been made in vain. He regretted, however, that they were still at issue with the Lisbon municipality in their interpretation of the contracts between them and the company. The unreasonable demands made upon the company had left the directors no alternative but a resort to the law courts. The board would, however, let no opportunity slip of coming to a friendly understanding, and negotiations were still in progress. In conclusion, he said the directors had no knowledge as to the truth or otherwise of the statements that had lately appeared in the Press as to the probability of disquiet again breaking out in Lisbon.

MR. FRANK ROBINOW seconded the motion, and the report was adopted.

Following the re-election of the directors and auditors, a resolution was agreed to voting the board a bonus of 1,200 guineas for their services during the past year.

Hong Kong Tramway Co., Ltd.

MR. E. C. MORGAN presided on Wednesday last week at the offices, 19, St. Swithin's Lane, at the meeting of this company. In moving the adoption of the report (see ELECTRICAL REVIEW, p. 850), he said that when they last met negotiations were proceeding for a readjustment of the capital so as to bring it more into line with the actual conditions of the undertaking, which had developed very much since its inception. Those negotiations were carried through, having been sanctioned by the shareholders and confirmed by the High Court in December, 1910. The name of the company had been altered. These changes did not appreciably alter in any way the figures in the accounts before them. Comparing these with the figures for 1909, they would notice that the receipts for 1910 exceeded those of 1909 by £1,223, in spite of the fact that the loss on the subsidiary coinage in 1910 was greater by £2,800, whilst the expenses in 1910 were reduced by £1,483. It was obvious, therefore, that had it not been for the disturbing element in the loss of the coinage the undertaking would have made considerable progress. They had always been alive to this weak spot in their system, and they had informed the shareholders from time to time of the difficulty, and of the steps they had taken to induce the Government to take measures to put the coinage on a stable basis. Unfortunately hitherto they had not seen their way to adopt any effective remedy, and when the company found that their loss increased, they thought it time to take matters into their own hands and endeavour to shield themselves from further loss. They, therefore, determined to discriminate between British and Chinese copper by requiring the payment of 5 cent fares if made in Chinese copper to be 6 cents. This change in fares was only brought into operation towards the end of last year, but it had not seriously affected the number of passengers, nor had there been any protest against the additional charges. Of course, their action had not checked the depreciation of the subsidiary coinage, but it had created an improvement in their receipts, inasmuch as they were now receiving more silver coins, which were not depreciated to such a large extent. They were still urging the Government to adopt some method of placing the coinage of the colony on a more secure and statesmanlike basis. The shareholders would note with satisfaction that a considerable reduction had been made in the expenses, and further efforts in that direction were continuously being made, but he could not hold out hopes of any very important further savings being possible, for there was little room anywhere for further reductions. The surplus on the working amounted to £8,557, but with this they could not deal for the present, as it was being ear-marked as a contribution towards further capital expenditure which they were bound to make under agreement with the debenture-holders. Probably the whole of the agreed additional capital expenditure, viz., £10,000, had been met or provided for by the purchase of a further supply of cars, and in the land and buildings needed for their accommodation. As those new cars came into operation their conditions of working would be greatly assisted, and the further land and buildings purchased would be a valuable addition to the assets. He would like to record the thanks of the directors and the shareholders to the manager and the staff in Hong Kong for their efforts to improve the position of the company, which he thought they must recognise had been attended with success, in spite of the dead-weight loss occasioned by the coinage. They only

hoped that the continuous efforts they made to improve matters in this direction would put them in a more satisfactory position, when he thought it would not be unreasonable to hope that the future of the company would reward the patience of the shareholders by yielding an adequate return on their investment.

MR. R. MILLER seconded the motion.

MR. DICKINSON congratulated the board on the improved position. He pointed out that there had been an increase in the mileage run and a rather substantial decrease in the cost of fuel, and he would like to know whether that was due to the decreased cost of coal or to the greater efficiency of their engines. He would also like to know how the agency fees were fixed, as they were higher this year. He congratulated the board on having at last done something with regard to the coinage, for he had always contended that something should be done. In an unofficial talk with an official in the Colonial Office, he gathered that the sympathy of the Colonial Office was with the directors in this matter. Whether it went beyond that he did not know.

The CHAIRMAN said he was afraid it did not. The saving was partly accounted for by more economical working, and partly from the fact that they had got coal cheaper, but, of course, that could not be relied upon. As to the agency fees, the agents whom they were bound to have, simply said it did not pay them to act for the company at the old fees, and so practically the board had very little option in the matter. The board had constantly reduced expenses, but he thought they had about reached the irreducible minimum.

MR. DICKINSON said the shareholders would appreciate a certificate accompanying the report that the works were properly maintained.

The CHAIRMAN said that such a certificate would be that of the men whose business it was to make out that everything was in order. If they had no confidence in the men they could have no confidence in his certificate, for there was no other expert they could call in.

The report was then adopted.

Johnson & Phillips, Ltd.

THE sixth annual meeting was held on Thursday last week, at Winchester House, E.C., Mr. R. W. Blackwell presiding

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 850), said that the gross profit for the year, after charging to revenue £5,327 for maintenance, had amounted to £23,175, and, adding £942 brought forward, it left them £24,117 to deal with. From that had to be deducted £1,563 remuneration of directors, auditors and trustees' fees, debenture interest £8,960, and debenture reserve £5,438. It was proposed to write off £6,000 for depreciation on machinery, plant and investments, which left £2,154 to be carried forward. The increase of profit over the preceding year had been £7,815, and during the period under review they had added new machinery and plant, which was absolutely required in the development of the business, to the amount of £5,794. He did not think the balance-sheet gave cause for any jubilation on the part of the shareholders, but it was only fair to say that it marked a very distinct advance from the position into which the company had got owing to the bad business of several preceding years. The directors had seen fit to suggest that a very considerable sum should be written off for depreciation during the present year. That was due to the fact that during the period of their greatest depression, three years ago, some question arose as to whether they had properly and sufficiently seen to those items, and therefore it seemed proper to increase the provision in the present year very substantially. As to the general business of the company, he thought he might fairly say that the corner had been very well and safely turned, and if the improved condition of business in the country continued, as it seemed likely that it would, he saw no reason why they should not look forward to a substantial advance year by year. During the whole time of the depression they had passed through, nothing had been neglected to strengthen the position of the company's works—they had done everything that was required to maintain them, and, where necessary, to throw out old machinery and to bring in new and better plant, and their shops and works in general were in a far better position to-day than they had been at any time since he had been chairman. In their cable works and in the shops where they were making machinery for the manufacture of cable, they had been practically full all the year round, and the turnover of the business had only been exceeded once during its existence. One or two shareholders had written him questions, and one was as to the price at which the debentures were issued. The debentures that were redeemed last year amounted to £7,130, and they paid £5,438 for them. As to the nature of the second debentures, and why they were not offered to the mass of the shareholders, he would like to inform them that the £50,000 second debentures were issued solely and entirely to provide working capital to carry out contracts which they had in hand, and that the total amount advanced against those debentures was advanced by members of the board. The company had a right to pay off those debentures at any moment, and they merely existed for the convenience of the company and to assist it in its business. Another question was why certain assets had been considerably increased over last year. If they looked at the figures the answer was very plain. The amount of business they had in hand at the present time was very large—they had in contracts and uncompleted orders work to the amount of £77,508, which was some £30,000 more than they had in the same month last year. The position of affairs was very much the same during the latter part of last year, and therefore it was impossible for them to carry on the business and obtain the necessary materials without finding accommodation, and that had been found by the board.

MR. THOMAS DEUCE, in seconding the motion, said that during the first three months of the present year, the amount of business done by the company constituted a record, and at the present moment there were sufficient orders in hand to keep the various manufacturing departments employed for the next six months. It might be asked why the results did not admit of the payment of a dividend on the ordinary shares. He would remind them that the company was formed in June, 1905, and was launched with a millstone round its neck in the shape of £175,000 5 per cent. mortgage debenture stock, and under the terms of the arrangement £13,000 had to be laid aside each year for interest on that stock, and a large sum had to be placed in reserve as a sinking fund for the redemption of the whole amount outstanding, which should be fully accomplished in 17 years from now—in 1928. Of the debenture stock, £32,740 had already been redeemed, leaving £142,260 outstanding. They undoubtedly should have further working capital to enable them to carry out to the best advantage the numerous orders and contracts which they had on hand, but they were unable to raise it by any fresh issue of shares which would have to rank behind the debentures. They could, therefore, only cut their coat according to their cloth, by using the net profit they were making to strengthen their financial position. He did not consider that the present position was unsatisfactory, while the future prospects were most promising. In five and three-quarter years they had paid £30,239 in dividends on the ordinary shares, and £45,845 in interest on debenture stock, and further, they had redeemed £32,740 of debenture stock out of profits. They had also expended £65,244 in new buildings and plant, besides writing off £22,700 for depreciation and £25,500 for maintenance. The sum set aside during the present year for the redemption of debenture stock would have been sufficient to provide a dividend of 3¼ per cent. on the ordinary shares. He was determined to spare no effort to place the company upon the satisfactory basis upon which he considered it could and ought to stand, and he saw a brilliant future in front of them. They only needed to exercise patience and perseverance, and the end was certain. They must as quickly as possible get rid of the debenture stock, and he would not be willing to wait 17 years to effect that object. They had already taken preliminary steps to that end, for until that incubus was got rid of they could not hope for a dividend on the ordinary shares. He held the largest number of ordinary shares, but he was willing to wait in the full assurance that the harvest when it did come would be a good one.

The report was adopted.

Rangoon Electric Tramway and Supply Co., Ltd.

THE fifth annual meeting was held at 3, Great Winchester Street E.C., last Friday. The report of the directors for the year ended December 31st, 1910, showed that there had been no change in the issued share capital. The debenture stock issued during the year was £21,658, making £186,606 less £3,863 for debenture stock redeemed = £182,743. The new power house had been completed and was ready to receive the 2,500-KW. turbine which had arrived at Rangoon. The permanent way, cars, overhead and tramway equipment had been maintained in an efficient state. The cars travelled 1,472,471 miles, against 1,459,463 miles during 1909, an increase of 13,008 miles, and carried 9,281,817 passengers, against 9,308,674 for 1909, the receipts being Rs. 8,79,245, as compared with Rs. 8,76,986, an increase of Rs. 2,258. The managing agents report that the year 1909 and the early part of 1910 was a particularly good period for the tramways, as it embraces certain religious festivities which do not regularly occur. There has been a steady increase in the number of consumers of current for lighting and power; the receipts have been Rs. 2,91,183, against Rs. 1,98,234 for 1909, an increase of over 46 per cent., while the working expenses were 51·13 per cent., as against 64·08 per cent., a decrease of 12·95 per cent. The gross profits for the year were £46,177 (as compared with £45,170 for the 13 months ended December 31st, 1909), plus £441 for transfer fees and interest on deposits, making £46,618. There are to be deducted interest on debenture stock, £8,121; provision for redemption of debenture stock, £4,618; depreciation on live stock, harness, furniture, &c., in Rangoon, £632; transfer to reserve for renewals account, £7,500; expenses in Liverpool (now London), £2,850; leaving £22,896, plus £621 brought forward. Preference dividend to December 31st, 1910, required £15,000, and formation expenses written off, £614, leaving £7,902. Out of this the directors recommend a dividend on the ordinary shares of 4 per cent. for the year, free of income-tax, which will absorb £7,080, and to carry forward £822. Sir Frederic W. R. Fryer, K.C.S.I., late Lieutenant-Governor of Burma, has accepted a seat on the board.

MR. FRANK TOBIN, presiding at the meeting, said that it was the first meeting held in London, the board having considered it advantageous for certain reasons to remove the head offices from Liverpool. During the year they had expended £22,000 on capital account, which they had raised by the issue of debenture stock. The power house had consumed the greater part of that expenditure. They had considered it advisable to increase the capacity of the power house by ordering a new turbine of greater power. That would be erected and ready for work within about two months from the present time. The bulk of the cost would fall upon the current year's accounts. This year they had taken £7,500 out of profits and added it to the reserve for renewals account. That fund was now £12,500, and in a company of that importance it was desirable that the fund should be built up to a really substantial figure. They had that in their minds, and had made a start to that end. Last year they put £5,000 to that fund. That was not the only

provision in the way of taking care of their capital. They were obliged by their articles to wipe out a certain amount of debenture stock each year, which was practically the same as writing off for depreciation. The receipts of the tramways last year brought them £58,616, against £62,867 for the 13 months in the corresponding period, or approximately the same income. Light and power, from which hitherto their income had been comparatively small, showed a notable improvement, having amounted to £31,927, against £26,528. They had an ideal before them, which was that they should be able to produce their revenue at a cost of 50 per cent. They had not quite achieved that yet, but they were drawing nearer to it year by year. For the 13 months to December, 1909, the expenses were 52 per cent.; last year they were 51½ per cent. He thought they might regard that as a very satisfactory figure, but they had hopes of improving it to a small extent. As regarded the outlook for business, he thought they would have to recognise the fact that apparently the tramway under present conditions had attained its full earning power, and that it would not increase considerably except through the gradual growth of the population. In the case of public lighting and power, this was the first year in which they could say that they had really made substantial progress, and in which they had seen anything like an adequate income from the large amount of capital that had been expended, and he felt very hopeful that when he met them next year he would again have very satisfactory figures to put forward in regard to that branch of their work. It was impossible for any board at this distance from the point where the company was working, to control its affairs successfully without very able and powerful assistance on the other side, and the board fully recognised what they owed to their able and tactful agents and staff in Rangoon.

SIR F. W. R. FRYER, K.C.S.I., seconded the motion, and the report was adopted.

Bergmann Elektrizitätswerke Gesellschaft.

THE reduction in the high rate of dividend that has been maintained for several years, which was foreshadowed at the last general meeting of the youngest of the large German electrical firms, has now become an accomplished fact. After paying 18 per cent. in each of the past five years on a share capital rising from £500,000 to £1,050,000, it is now proposed to distribute 12 per cent. on the latter amount for 1910 and 1½ per cent. on new shares, totalling £400,000. After allocating £76,000 to depreciation as against £66,000 in 1909, the net profits and balance forward are returned at £162,000, as compared with £195,000 in the preceding year. The report of the directors states that the diminution in the net profits was due to the price contest which prevailed in nearly all branches, the increase in working expenses in consequence of the erection of new works and equipment, and the extensive participation in the Brussels Exhibition. The scope of the machine department was extended and the equipment for mines and ironworks was well developed. Orders for traction motors were numerous, and the State requisitioned further accumulator cars and a main line electric locomotive of 1,500 H.P., the trials of which were shortly to take place. In the lamp department the sales of carbon-filament lamps slightly declined, but those of the metallic-filament type increased, although the new factory was not ready for the winter season. Overtime had in fact to be worked in the department for conduit tubes and installations, and the turnover in meters was doubled. A further building for the construction of turbines was to be started in the next few months, but underselling in turbines continued, despite the growing demand. The manufacture of insulated wires was combined with the cable factory, together with a rubber factory for the purpose of coping with the increasing fall in the prices of conductors by the production of rubber on their own account. In the lead cable branch prices were better, although the long-term contracts dating from the temporary cessation of the cable syndicate were still perceptible. The number of employés is 10,000 at the present time as compared with 7,500 at the end of 1910 and 5,000 at the close of 1909. It is added that the orders brought over into 1911 were almost twice the amount of those prevailing a year previously, and the orders invoiced in the first quarter of 1911 represented £200,000 more than in the equivalent quarter in 1910. The company already has an issue of bonds amounting to £500,000, and a further issue of a similar sum is now in contemplation.

Swiss Electrical Companies.

THE Motor, Gesellschaft für Angewandte Elektrizitäts, of Baden, which is closely connected with Brown-Boveri & Co., and which both owns and is otherwise interested in electric supply works, reports that very few new transactions were carried out during 1910. Whilst the erection of generating stations, tramways, &c., was largely developing in neighbouring countries, the movement in Switzerland had almost reached a standstill, as the Cantonal Authorities themselves were undertaking the supply of their respective districts to an increasing extent. The accounts for 1910 show net profits, including the balance forward, of £49,000, as contrasted with £51,000 in the previous year, and a dividend of 6½ per cent. has been declared, as against 6 per cent. in 1909.

The Schweizerische Gesellschaft für Elektrische Industrie (Swiss Electrical Industry Co.), of Basle, which is closely associated with the Siemens & Halske group, states that the various undertakings in which the company is interested, experienced a satisfactory course of development in 1910. As gross profits the accounts exhibit the sum of £98,000, as contrasted with £97,000 in 1909, the net profits being £48,000, as against £47,000 in the previous year. The payment of a dividend of 7 per cent. on the ordinary paid-up capital of £400,000 was approved at the recent meeting, or the same rate as in 1909. The company also has a bond capital amounting to £1,200,000, which involves an annual charge of £48,000 for interest service.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which chiefly acts as a promoting and investment company, reports a reduction in the receipts from 1910, in consequence of a diminution of the dividends or the omission to make any distribution on the part of the subsidiary companies, particularly in the electro-metallurgical and chemical group. Including the balance brought forward the accounts show net profits of £43,000 for 1910, as compared with £46,000 in the preceding year. After placing £4,400 to the reserve fund, as against £4,600 in 1909, the balance has permitted of the payment of a dividend of 4 per cent., being the same rate as in the previous year. The share capital amounts to £1,000,000, and the bond capital to £988,000. The report states that the work of the subsidiary companies in France and Italy will be completed in the present year, and the sale prices realised for the products of the electro-metallurgical companies should improve in consequence of the international understanding among the makers.

The directors of the Elektrizitats Gesellschaft Alioth, of Basle, refer in their report for 1910 to the community of interests which was established with Brown-Boveri & Co., of Baden, last September, and state that almost all the shares in the former had been exchanged for shares in the latter company. Notwithstanding the prevalence of keen competition the works of the Alioth Co. were satisfactorily employed during the whole of the year, and a gratifying development of sales had taken place in France in particular. The gross profits amounted to £28,300 as contrasted with £36,700 in 1909, and a dividend at the rate of 6 per cent. has been declared both on the ordinary and preference capital of £240,000, being the same as in the preceding year. The deliveries of transformers comprised 1,746 of 109,693 KW., as compared with 1,210 of 75,562 KW. in 1909, whilst the generators and motors numbered 6,153 of 116,276 H.P., as against 4,650 of 107,701 H.P. in the previous year.

Deutsch-Niederlandische Telegraphen Gesellschaft.

—The recent meeting of the shareholders approved the report and accounts for 1910 and the payment of a dividend of 6½ per cent., being the same rate as in the preceding year. The report stated that, as a result of the material improvement in trade in the Far East, the telegraphic traffic considerably increased as compared with the previous 12 months, and the cable receipts were £13,000 greater than in 1909. Of the latter sum 10 per cent., or £1,300 devolved upon the company, whilst the remaining 90 per cent. was paid back to the German and the Dutch Governments on their subsidies. The accounts show that cable maintenance necessitated an expenditure of £10,000 as in 1909; the cable renewal fund has been allotted £8,700, the cable maintenance fund £4,200, and the depreciation fund £2,200. The net profits amounted to £38,000, as against £37,000 in 1909, on an ordinary share capital of £350,000, and the obligations in existence have been reduced to £311,000.

Continental. — FRANCE.—The balance-sheet of the Société Havraise d'Energie Electrique, of Havre, for the last financial year shows a profit of £54,363, as contrasted with £51,702 in the previous 12 months.

The Compagnie Générale d'Eclairage et de Transport de Force par l'Electricité, of Paris, reports a profit of £17,169 for the last financial year.

La Société Française de l'Accumulateur Tudor, of Paris, reports a profit of £17,974 for the last financial year.

BELGIUM.—The report of the Bell Telephone Manufacturing Co., of Antwerp, for the last financial year shows a profit of £19,920.

The balance-sheet of the Société des Accumulateurs Tudor, of Brussels, for the last financial year, shows a profit of £8,686.

RUSSIA.—La Société de l'Eclairage Electrique de St. Petersburg has just issued a very satisfactory report for the last financial year. It shows a profit of £183,119, as compared with only £162,794 in the preceding 12 months. The company has now 19,710 clients, as against 16,549 a year ago, the output in 1910 amounting to 20,911,363 KW.-hours, as compared with 19,273,857 KW.-hours in 1909. The cost of production per KW.-hour declined from ·665d. to ·607d. The length of the mains now in use extends to 435 km., and with the view of meeting the increasing demand, the installation of a new steam turbine and generator of 6,700 H.P. at the generating station has been decided upon.

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange has gone through an uncomfortable week since our last letter was written. There have been all kinds of trouble, domestic and foreign. Amongst the first must be ranked the disappointment felt at the stiffening of money just at the time when everyone expected that the Bank Rate would come down. Added to this, there has been a whole host of new issues, some of which have not gone particularly well. So far as foreign affairs

are concerned, Mexico still continues to provide the chief nigger in the hedge.

After being decidedly weak, the Home Railway market took a turn for the better on Monday, when a long catalogue of rises helped to wipe out some of the declines of the previous week. In this improvement the electric stocks have had no hand. In fact, they nearly all show falls, chief amongst which is a drop of 5 in Central London Deferred. The Ordinary stock is three points lower, but there is no change in the Preferred. The reason for the fall seems to be that weak holders, who had bought the stocks in anticipation of the Exhibition were forced out of their holdings in the general depression which prevailed a few days ago, and the market has not yet had time to rally from this liquidation. City and South London Ordinary is down 1½, and both the older undergrounds have suffered, with the single exception of Metropolitan Surplus Land stock, which is up 2 points. In sympathy with this weakness, Underground Electric Railways Income Bonds lost a point. Probably the falls have been already overdone, and a recovery seems more than likely.

Amongst the Home Tramway issues, there is a better tone in Metropolitan Electric Trams, the Ordinary shares having risen to very nearly par, and the 5 per cent. Debenture gaining ½. The Deferred shares, however, show no change, and there is not much doing in them at the present price of about 3s. British Electric Traction Ordinary put on ⅛, although the Preference shares gave way to the same extent. London United Tramways retain their big rise, but the Debenture stock has receded a trifle.

The colonial and foreign section of Electrical Railways and Tramways has been chiefly noticeable for the fluctuations in Mexican and Canadian-American issues. Rio Trams have been a particularly lively market, moving sharply between 111 and 114½. On balance, the price shows a small gain on the week, and the 5 per cent. Mortgage Bonds are harder. Sao Paulos, after their big jump, reacted to a very slight extent, and the Mexico Tramway group is slightly easier, reflecting the unsettled conditions which still prevail in the country. There are several fresh issues coming in connection with South American companies, but these are mainly held up by reason of the unpropitiousness of the times, though they will probably make their appearance soon after Whitsun. Cape Electrics continue to quietly improve, and some of the Debenture stocks in this department are firmer; which seems to show that, in spite of all the attractions recently offered him, the investor still goes on buying older issues which have a fair margin of security.

The Mexican Light and Power trio is also rather easier, and Mexican Electric 5 per cent. Bonds fell ½. The news from Mexico is so conflicting day by day that great caution is necessary in accepting intelligence, either good or bad, but the resignation of the venerable President ought to pave the way for quieter times, while the hint of intervention by the United States if the Mexican revolutionaries should get too unruly should be noted gratefully by proprietors of Mexican stocks and shares of any kind. Canadian General Preferred is creeping up on the idea that the stock is still cheap, regarded as a speculative investment, and a point gain in Shawinigan Capital stock was caused by anticipations of an advance in the dividend.

The English Electricity list is so quiet as to be almost stationary, and the only movements worth noticing are declines in Edmundson's Ordinary and Preference, while Metropolitan Ordinary fell ⅛, and Westminster are ¼ lower. Charing Cross Preference hardened to the extent of half-a-crown. Electric Supply Corporations have not been affected by the new issue of 5 per cent. Debenture stock at 90, particulars of which have already been mentioned here. The stock offers a reasonably good investment of its kind, but, in view of the public's fastidiousness at the present moment in the matter of new issues, the market will, no doubt, experience no surprise if the public should not take all the stock offered. This, however, would make no difference to the company, because the issue was allotted and paid for before the prospectus appeared. The price, of course, was lower than that at which the emission was made to the public.

In the Telegraph and Telephone list there has been a little animation in Anglo-American stocks, but apparently no further progress has been made in the negotiations between this company and the American concerns which are interested in the proposed agreement. Western Union Funding Bonds put on 1½ and one or two other prior charge stocks are better. The Eastern group is decidedly harder, good buying of Eastern Ordinary having taken the price up 2½ points, while Eastern Extension shares are ½ up. On the other hand, Great Northern shares lost their rise of last week, and Marconi's had to put up with a small reaction, which is not very surprising, in view of the sharp rise which they have had just lately. But they soon regained the loss, and are again very hard. Globe Telegraphs have risen.

National Telephone Deferred gained 3 points, but lost them again, and the Third Preference rose 1/16, the advance being attributed to bear closing, because the rise happened to come on the carry-over day last Monday. The rumours as to the Government having come to terms with the company were politely ridiculed. Other Telephones are unchanged. Amongst manufacturing shares, India-Rubbers are ½ down, but General Electric Preference gained an equal fraction, and the Debenture rose 5 points, as the company is said to be doing exceedingly well out of its Coronation business. Babcock & Wilcox shares are a trifle easier, but beyond these changes there has been no material alteration in this group. The Callender's report is good, the results keeping on a remarkably even level with those of the previous year. The Brush Electrical report serves to emphasise the necessity for reorganising the capital account of the company, and the sooner the unpleasant task is taken in hand, the better it may be.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc
Aberdeen	May 24	2,797	+ 7	51	70,975	+ 2,120	..	..
Ayr	„ 27	564	+ 15	..	..	..	8	..
Bath	„ 27	2,049	— 183	21	15,469	— 173	..	..
Belfast	„ 26	9,075	+ 704	8	35,698	+ 4,331	37	..
Birkenhead	„ 28	2,254	+ 11	8	9,204	+ 324	13·68	..
Birmingham Corp.	„ 20	14,329	— 183	7	52,101	+ 2,469	56·79	..
Blackburn	..	..	..	..	..	..	..	..
Blackpool Corp.	„ 25	1,957	—2,271	..	6,799	+ 206	..	..
Blackpool-Fleetw'd	„ 29	904	—1,179	21	7,394	— 876	..	..
†Bolton	„ 21	2,568	— 827	8	18,778	+ 1,400	26	..
Bournemouth	„ 24	3,223	— 625	7⅝	13,088	+ 96	21·9	..
Bradford	„ 20	10,774	— 691	7	39,123	+ 2,271	54·8	..
Brighton	„ 28	2,080	— 87	8⅔	8,029	+ 493	9·5	..
Bristol	„ 26	12,684	—1,412	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 19	439	— 13	20	4,222	— 56	3·65	..
Barnsley	„ 19	375	+ 1	„	3,502	+ 96	..	..
Barrow	„ 19	544	— 73	„	4,838	+ 205	5·37	..
Cavehill	„ 19	168	— 51	„	1,444	— 83	..	..
Devonport	„ 19	939	+ 50	„	8,738	+ 678	8·85	..
Gateshead	„ 19	2,042	+ 42	„	19,832	+ 926	11·25	..
Gravesend	„ 19	408	— 67	„	3,729	— 82	6·5	..
Greenock	„ 19	1,526	+ 130	„	12,760	+ 1,740	7·25	..
Hartlepool	„ 19	502	+ 26	„	4,428	+ 170	6·72	..
Kidderminster	„ 19	208	— 116	„	1,812	— 51	..	..
‡Leamington	„ 19	305	— 75	„	2,760	— 175	..	..
Merthyr	„ 19	413	— 91	„	3,863	— 24	2·9	..
Metropolitan	„ 19	16,034	— 166	„	160,5·2	+20,883	22	..
Middleton	„ 19	680	— 28	„	6,018	+ 166	8·5	..
Mid. Joint Com'tee	„ 19	12,141	—1,329	„	95,062	+ 3,666	..	..
Oldham—Ashton	„ 19	1,147	— 49	„	10,·27	- 256	9·13	..
Peterborough	„ 19	2·8	— 74	„	2,110	+ 46	5·31	..
Potteries	„ 19	3,861	+ 138	„	37,760	+ 3,320	29	..
Rothesay	„ 19	252	— 1	„	1,52[illegible]	— 43	2·75	..
Southport	„ 19	630	— 141	„	5,007	— 7[illegible]	8·17	..
S. Metropolitan	„ 19	1,865	+ 207	„	14,955	— 182	..	..
Swansea	„ 19	2,159	— 311	„	21,0·6	+ 1,0·8	12·5	..
Tynemouth	„ 19	409	— 207	„	3,295	— 90	3·75	..
Weston-s-Mare	„ 19	215	— 195	„	509	— 285	3	..
‡Worcester	„ 19	604	— 69	„	5,012	— 35	5·75	..
Wrexham	„ 19	195	— 33	„	1,852	— 21	..	..
Yorks. Wool. Dist.	„ 19	2,148	— 136	„	19,955	+ 1,038	17	..
Miscellaneous	„ 19	464	— 9	„	4,017	+ 103	..	..
Burnley	„ 27	2,740	— 35	..	..	..	11·73	1
Burton-on-Trent	„ 28	528	— 47	8	2,198	+ 27	6·6	..
Bury	„ 28	2,556	— 193	8⅔	10,581	+ 689	22·5	..
Cardiff	„ 20	4,7·2	— 41	7	16,688	+ 815	..	..
Chatham and Dist.	„ 25	1,658	— 391	21	16,253	— 230	14·98	..
Cork	„ 25	1,141	— 23	21	9,535	— 7	9·89	..
†Croydon	„ 19	1,754	— 152	..	12,577	+ 478	..	..
Darlington	„ 27	429	— 42	9	1,852	— 143	..	..
Darwen	„ 26	592	— 4	8	2,166	+ 181	4·36	..
Dover	„ 20	434	— 24	7	1,617	+ 190	4·75	..
Dublin	„ 28	11,716	— 723	..	109,450	+ 812	54·2	..
Dundee	„ 24	2,354	— 99	..	..	..	15	..
East Ham	„ 27	2,085	— 295	8½	8,679	+ 319	7·87	..
Exeter	„ 26	685	+ 103	8	2,607	+ 73	5·5	..
Glasgow	„ 27	40,981	+2,679	..	935,180	+41,926	97·75	..
Hastings	„ 25	1,887	— 493	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 27	5,405	— 157	8	23,003	+ 251	14·5	..
Ilkeston	„ 25	265	— 39	8	1,018	+ 50	..	..
Ipswich	„ 27	795	— 141	8	3,345	+ 246	10·5	..
Kilmarnock	„ 27	321	+ 18	..	..	..	4·25	..
Lancashire United	„ 21	2,751	— 511	21	26,497	+ 191	39	..
Leeds	„ 27	14,837	— 655	8	60,720	+ 4,104	57	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 27	1,325	+ 59	..	..	..	8·72	..
Liverpool	„ 20	23,053	— 103	20	220,793	+ 6,258	116	6·5
‡L.C.C.	„ 17	89,007	+ 460	..	294,636	+15,170	188	6
London United	„ 27	13,783	—3,725	..	115,858	— 1,422	..	..
Lowestoft	..	..	..	..	..	..	3·5	..
Manchester	„ 27	32,726	— 584	8	131,817	+ 8,000	183	..
Newcastle	„ 29	8,072	+ 331	..	33,716	+ 2,357	14·5	..
Newport	„ 20	1,105	— 143	7	5,100	+ 185	14·5	..
Oldham	„ 28	4,048	+ 109	9	18,202	+ 836	23·5	·5
Portsmouth	..	..	..	..	..	..	15·25	..
Preston	„ 24	1,514	— 199	8	6,009	+ 201	..	..
†Salford	„ 15	4,734	+ 8	6⅔	30,156	+ 2,511	..	..
Sheffield	„ 23	12,943	+ 501	9½	58,151	+ 3,059	40	..
Southampton	„ 24	2,2·7	— 408	8	8,654	+ 370	..	..
Southend-on-Sea	„ 24	1,127	— 1·3	8	4,263	+ 432	..	..
South Shields	„ 17	1,195	+ 38	8	4,915	+ 656	..	..
Swindon	„ 24	295	— 28	8	1,145	+ 71	..	..
Tyneside	„ 24	931	— 74	21	8,750	+ 527	..	..
Wallasey	„ 27	2,180	+ 105	8½	8,778	+ 1,319	..	..
Walthamstow	„ 27	1,486	— 477	8	6,191	+ 429	9	..
West Ham	„ 18	5,881	..	7	18,692	+ 1,787	15·35	..
Wolverhampton	„ 24	1,889	— 286	8	7,405	+ 416	25	..
Gen. London Rly.	„ 27	10,008	—2,787	21	109,668	— 8,245	6·29	..
City & S. Lon. Rly.	„ 28	6,094	+ 74	21	70,834	+ 2,503	7·26	..
Dublin-Lucan Rly.	„ 26	293	— 56	21	2,502	— 90	7	..
G.N. and City Rly.	„ 27	2 878	+ 123	21	34,499	+ 1,329	3·5	..
L'pool Overh'd Rly.	„ 28	2,918	— 59	..	29,695	+ 1,545	8·8	4·8
Llandudno-Col. Bay	„ 26	413	— 844	25⅞	9,908	— 217	..	..
London Elec. Ry. Co.	„ 27	26,775	—1,515	21	294,185	+13,450	21·25	..
Mersey Railway	„ 27	4,017	— 59	21	43,476	+ 978	4·5	..
Metropolitan Rly.	„ 28	34,365	— 990	..	355,648	+ 7,245	24·5	..
Met. District Rly.	„ 27	23,103	+ 85	21	249,342	+16,207	24	..
Anglo-Argentine	„ 27	27,525	+2,494	..	1,041,667	+113,484	..	..
‡Auckland	Mar.	15,434	+1,811	..	159,062	+16,291	23·8	·6
Bombay (B.B.T.)	April 28	5,641	+ 65	17	48,623	+ 2,528	..	..
Brisbane	April	19,410	+1,720	16	76,301	+ 7,781	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	May 27	7,252	+ 680	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A.	April	3,435	..	..	13,283	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 15	1,725	+ 406	..	7,550	+ 674	..	..
‡Montevideo	April	25,256	+2,508	26	166,176	+15,981	..	..
Perth (W.A.)	May 26	3,077	+ 66	..	31,413	+ 1,670	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 30th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	102 —104	..	4 6 7
Brompton & Kensington, Ord.	5	10	10	7⅞ — 8¼	..	6 1 3
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	100 —103	+ 1	3 17 8
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	+ ⅛	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Chelsea, Ord.	5	4¼	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	100 —102	..	4 8 3
City of London, Ord.	10	7	7	11¾ — 12¼	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	120 —124	+ 1	4 0 8
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	92 — 94	..	5 6 5
County of London, Ord.	10	5	5	7⅝ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	10⅝ — 11⅛	..	5 7 5
Do. 4½ % Deb.	Stock	4½	4½	109 —111	— ⅜	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	1⅛ — 1⅜	— 1/16	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅝ — 3⅛	— ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4⅜ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7¼	..	6 11 0

NAME.	Stock or Share.	Dividends for		Closing Quotations May 30th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅜ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	5	5	3⅝ — 4⅛	— ⅛	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 16 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 89	..	3 18 8
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97 — 99	..	4 10 11
Newcastle-on-Tyne	5	4	4	3⅞ — 4⅛	..	4 14 2
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	+ 4	4 18 0
Notting Hill	10	7½	8	12 — 12⅜	..	6 5 6
Oxford	5	7	7½	6 — 6⅜	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8⅜ — 9¼	..	5 8 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	Nil	1⅝ — 1⅞	..	Nil
South London, Ord.	4	5	5	3 — 3½	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	101 —104	..	4 16 2
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	+ 2	4 10 0
Urban, Ord.	5	5	3½	⅞ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3½	2⅝ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	7¾ — 8⅛	— ¼	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	7†	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	6	6	111 —114	..	5 5 3
Do. 7 % Pref.	$100	7	7	121 —124	+1	5 12 11
Cordoba Lt., Power and T., Ord.	1	..	6	⅛ — ⅛	..	6 8 0
Do. 5 % Deb.	100	5	5	93 — 96	+1	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	97½ — 99½	..	6 0 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83½ — 85½	..	5 17 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/32	..	..
Do. 6 % Pref.	1	6	6	13/16 — 29/32	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 3
Madras, Ord.	5	Nil	Nil	3 — 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	94 — 96	..	5 4 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 90	— ½	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	84½ — 86½	— ½	4 12 6
Do. 7 % Cum. Pref.	$100	7	7	108 —110	..	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 95	—1	5 5 3

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	80½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	..	8	154 —157	..	5 1 11
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	71 — 73	..	6 17 0
River Plate, Ord.	Stock	9	10	218 —228 xd	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114 xd	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	104 —106	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	115 —118	+1	4 4 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108½ —110½	..	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	102 —104 xd	..	4 6 7
Toronto Power, 4½ % Deb.	Do.	4½	4½	101 —103	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	..	5 5 3
Victoria Falls Power, Pref.	1	Nil	Nil	13/16 — 1	..	Nil
Do. (new)	1	..	Nil	⅞ — 1	..	Nil
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99½ —101½	+ ½	4 18 6
American Telep. & Teleg., Cap.	$100	8	8	152½ —154½	+ ½	5 3 7
Do. Collat. Trust	$1000	4	4	95½ — 97½	..	4 2 1
Anglo-American Telegraph	Stock	3⅝	3¾	69 — 71	..	5 5 8
Do. 6 % Pref.	Do.	6	6	113½ —114½	— ½	5 4 10
Do. Def.	Do.	25/-	30/-	26½ — 27	+ ⅛	5 11 1
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 1/16 — 7 1/16	..	5 11 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	88 — 90	..	4 8 11
Cuba Telegraph	10	6	6	9⅜ — 10½	+ ⅛	5 14 3
Do. 10 % Pref.	10	10	10	17½ — 18½	+ ½	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅝ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	101 —103	+ ½	4 7 5
Direct United States Cable	10	4	5	7⅜ — 8⅛	..	6 3 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	140 —143	+2½	4 17 11
Do. 3½ % Pref. Stock	Do.	3½	3½	84½ — 86½	..	4 0 11
Do. 4 % Mort. Deb.	Do.	4	4	100½ — 102½	..	3 18 1
Eastern Extension	10	7	7	13⅞ — 14⅛	+ ⅛	4 18 3
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	11½ — 11⅝	+ ⅛	5 1 1
Do. 6 % Pref.	10	6	6	13¾ — 13⅞	+ ⅛	4 8 1
Great Northern Telegraph	10	18	18	31½ — 32½	— ½	5 10 9
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	93 — 96	..	5 3 1
Do. 4 % Cum. Pref.	$100	4	4	78 — 80	..	5 0 0
Marconi's Wireless Telegraph	1	Nil	Nil	1⅝ — 1⅞	+ 1/16	Nil.

Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	½ — ⅝	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —105	..	5 14 3
Do. Def.	Do.	6	6	127 —129	..	4 13 0
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	+ 1/16	4 6 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 2
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	..	4 10 0
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5	8¼ — 8½	..	4 11 5
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 9 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	6†	7⅞ — 7 13/16	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	..	1⅛ — 1⅜	..	..
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99½ —101½	..	3 18 10
West India and Panama Teleg.	10	Nil	⅛	2⅜ — 2⅝	..	1 18 1
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 10 4
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅝ — 10⅛	..	5 18 5
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	7	13⅜ — 14½	..	4 18 3
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 19 10
Western Union Tel., 4% Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ —102½	+1½	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations May 30th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1⅛ — 1⅝	+ ⅛	Nil
Do. 6 % Pref.	10	3	..	4 — 4½	— ⅛	..
Do. 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	73 — 75	—3	4 0 0
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	62 — 64	—5	3 2 6
Do. 4 % Deb.	100	4	4	104 —106	..	3 15 6
City & South London, Ord.	100	1½	1½	33 — 34	—1½	4 8 3
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —106	..	4 14 4
Do. Do. 1903	100	5	5	103 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅛ — 1¼	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1½ — 2	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2¼ — 2⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	79 — 84	..	4 15 3
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	98 —100	..	4 0 0
London United Trams, 5 % Pref.	10	Nil	Nil	3¾ — 4¼	..	Nil
Do. 4 % Deb.	100	4	4	76 — 79	—1	5 1 3
Metropolitan Railway Consol.	100	1	1⅛	51¼ — 51⅝	— ⅛	2 13 2
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	+2	3 18 7
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 18 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	32 — 32½	— ⅛	Nil
Do. 6 % Deb.	100	6	6	148 —150	..	4 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Do. 4 % Prior Lien	100	4	4	102 —104	..	3 16 11
Do. 4½ % First Pref.	100	..	3½	89 — 91	..	3 11 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5	5½	⅝ — 1	+ ⅛	5 6 8
Do. Def.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1/32 — 1 1/32	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	102½ —104½	— ½	4 6 2
Do. 5 % Deb.	100	5	5	100½ —103½	+ ½	4 16 7
Potteries, Ord.	1	2	..	1/16 — 3/16	..	..
Do. 5 % Pref.	1	5	5	⅜ — ½	..	6 19 2
Do. 4½ % Deb.	100	4½	4½	86 — 89 xd	..	5 1 2
South Metro. Trams, 6 % Pref.	1	3	..	1/32 — 3/32	..	..
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Underground Elec. Railways 5 % Prior Lien	..	5	5	100 —101	..	4 19 0
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	10/-	63 — 65	—1	0 15 4
Do. Power House Debs.	100	..	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2½	..	..
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 2nd Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	103 —105	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104½ —106½	..	4 13 11
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97¾ — 99⅞	+1	4 10 6
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8½	8½	6¼ — 6⅝	..	6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	+ 1/16	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	146 —150	..	5 6 8
Do. Pref. Ord.	100	6	6	126 —129	..	4 13 0
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	+ ½	4 7 0
Calcutta Trams, Ord.	5	4½	5	5⅛ — 6	..	4 3 4
Do. 5 % Pref.	5	5	5	5⅛ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	101 —104	..	4 6 7
Cape Electric Trams	1	Nil	Nil	3/32 — 5/32	+ 1/32	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5¼ xd	..	4 5 1
Do. 4 % Deb.	100	5	5	96 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100½ —102½	..	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	94 — 97	..	5 3 1
Do. 6 % B Deb.	100	6	5	66 — 70	..	7 2 10
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	1⅛ — 1⅜	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	98 —102	..	4 18 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	94 — 97	..	5 3 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com.	$100	6	7	124 —126	— ⅛	5 11 1
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 97	— 1/32	5 3 1
Do. 6 % Bonds	100	6	6	100½ —102½	—1⅛	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅛	— ⅛	6 17 11
Do. 6 % Pref.	5	6	6	5⅞ — 5⅞	— ⅛	5 2 2
Do. 5 % 1st Deb.	100	5	5	99 —101 xd	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1⅜	..	2 18 4
Do. 5 % 1st. Deb.	100	5	5	104 —106	..	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	99 —102	..	4 8 3
Rio de Janeiro Trams	$100	2	5	113½ —114½	+ ¾	4 7 4
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	96¾ — 97¼	+ ¼	5 2 10
Sao Paulo Tram, Lt. and P.	$100	10	10	177 —179	—1	5 11 9
Do. 5 % 1st Deb.	$500	5	5	105 —107	+ ½	4 13 6
Singapore Trams, 5 % Deb.	100	5	5	82 — 86	..	5 16 3
Southern El. Tr. B.A., 5 % Deb.	..	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5⅜ — 6⅜	..	5 7 8
Do. 6 % Pref.	5	6	5	5 — 5⅛	..	4 10 11
Do. 5 % 1st Deb.	100	5	6	101 —104	..	5 15 5
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½ —107½	+ ½	4 3 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	..	9/32 — 11/32	..	..
Do. 6 % Pref.	1	12	9	13/16 — 15/16	..	7 2 0
Babcock & Wilcox	1	24	20†	5⅜ — 5⅝	— 1/16	4 7 3
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	⅜ — ½	..	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 0
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	Nil	1/32 — 1/16	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	1/16 — ⅛	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	41 — 46	..	9 15 7
Callender's Cable	5	15	10†	9⅜ — 9⅞	..	7 13 5
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Castner-Kellner	1	17½	7½†	31⅜ — 31⅞	..	4 19 2
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	70 — 80	..	6 5 0
Dick, Kerr	1	5	6	⅞ — 1	..	6 0 0
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	Nil	1/32 — 1/32	..	Nil
Do. fully paid	5	Nil	Nil	1/32 — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	⅜ — 1	..	Nil
Do. Pref.	2	7	7	1⅜ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10⅛ — 10⅜	..	6 10 3
Do. Deb.	100	5	5	102 —103½	..	4 16 7
General Electric, Pref.	10	5	5	8¾ — 9⅛	+ ⅛	5 8 1
Do. Deb.	100	4	4	88 — 93	+5	4 6 0
Henley's, Ord.	5	15	15	12⅛ — 12⅝	..	5 16 6
Do. Pref.	5	4½	4½	4⅛ — 5⅛	..	4 6 9
Do. Deb.	100	4½	4½	108 —110	..	4 1 10
India-Rubber, G. & T.	10	10	10	16 — 16⅜	— ⅛	5 19 5
Do. Pref.	10	5	5	10⅜ — 10⅝	+ ⅛	4 13 0
Telegraph Construction	12	17½	20	36⅛ — 38½	..	6 5 0
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. Pref.	5	3	Nil	¾ — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 8 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

TRADE STATISTICS OF EGYPT, 1910.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1910, is taken from the recently issued trade statistics. The figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1909. £E.	1910. £E.	Increase or decrease. £E.
Steam engines, including boilers, &c.—			
From Great Britain ..	77,000	70,000	— 7,000
,, Germany	8,000	8,000	—
,, Belgium	3,000	1,000	— 2,000
,, United States ...	1,000	—	— 1,000
,, France	2,000	2,000	—
,, Greece	1,000	1,000	—
,, Holland	1,000	3,000	+ 2,000
,, Italy	6,000	6,000	—
,, Switzerland ...	10,000	3,000	— 7,000
,, Austria-Hungary...	—	2,000	+ 2,000
Total ...	109,000	96,000	— 13,000
Electric machinery (including gas engines and petrol engines).—			
From Great Britain ...	22,000	52,000	+ 30,000
,, Germany	11,000	23,000	+ 12,000
,, Austria	1,000	1,000	—
,, Belgium	11,000	7,000	— 4,000
,, United States ...	1,000	1,000	—
,, France	5,000	14,000	+ 9,000
,, Italy	4,000	4,000	—
,, Switzerland ...	8,000	11,000	+ 3,000
Total ...	63,000	113,000	+ 50,000
Other machinery (except agricultural).—			
From Great Britain ...	68,000	71,000	+ 3,000
,, Germany	26,000	23,000	— 3,000
,, Austria	4,000	2,000	— 2,000
,, Belgium	7,000	3,000	— 4,000
,, United States ...	20,000	26,000	+ 6,000
,, France	23,000	24,000	+ 1,000
,, Greece	1,000	—	— 1,000
,, Italy	3,000	4,000	+ 1,000
,, Switzerland ...	5,000	3,000	— 2,000
,, Turkey	1,000	1,000	—
,, Other countries ...	—	1,000	+ 1,000
Total ...	158,000	158,000	—
Railway and tramway carriages.—			
From Great Britain ...	1,000	55,000	+ 54,000
,, Belgium	14,000	34,000	+ 20,000
,, France	—	5,000	+ 5,000
Total ...	15,000	94,000	+ 79,000
Lamps of all kinds.—			
From Great Britain ...	8,000	8,000	—
,, Germany	16,000	20,000	+ 4,000
,, Austria	21,000	28,000	+ 7,000
,, Belgium	1,000	3,000	+ 2,000
,, France	7,000	7,000	—
,, Italy	1,000	—	— 1,000
,, Sweden	12,000	11,000	— 1,000
,, Turkey	1,000	1,000	—
,, Other countries ...	1,000	3,000	+ 2,000
Total ...	68,000	81,000	+ 13,000
India-rubber and gutta-percha, raw or manufactured.—			
From Great Britain ...	6,000	7,000	+ 1,000
,, Germany	14,000	13,000	— 1,000
,, Austria	3,000	4,000	+ 1,000
,, France	15,000	13,000	— 2,000
,, Italy	4,000	5,000	+ 1,000
,, Switzerland ...	—	1,000	+ 1,000
,, Belgium	—	1,000	+ 1,000
Total ...	42,000	44,000	+ 2,000
Electric, telegraphic and telephonic apparatus.—			
From Great Britain ...	43,000	52,000	+ 9,000
,, Germany	13,000	19,000	+ 6,000
,, Austria	12,000	20,000	+ 8,000
,, Belgium	7,000	12,000	+ 5,000
,, United States ...	1,000	1,000	—
,, France	13,000	19,000	+ 6,000
,, Italy	5,000	3,000	— 2,000
,, Sweden	3,000	5,000	+ 2,000
,, Switzerland ...	5,000	3,000	— 2,000
Total ...	102,000	134,000	+ 32,000
Scientific instruments.—			
From Great Britain ...	19,000	19,000	—
,, Germany	17,000	17,000	—
,, Austria	1,000	2,000	+ 1,000
,, United States ...	2,000	1,000	— 1,000
,, France	9,000	14,000	+ 5,000
,, Italy	1,000	1,000	—
,, Switzerland ...	1,000	1,000	—
Total ...	50,000	55,000	+ 5,000

£E = £1 0s. 6½d.

CHANNEL-IRON SUPPORTS FOR ELECTRIC TRANSMISSION LINES.*

By R. E. NEALE, A.C.G.I., B.Sc.

METAL supports for transmission line conductors are usually of lattice tower, hollow tube or reinforced concrete construction, but, during the last few years, several important Italian and French lines have adopted a pole-construction, affording great rigidity perpendicular to the line, but considerable flexibility along the line. The Italian design has used two channel irons fixed vertically in a concrete foundation, the channels being about 2 metres apart and suitably cross-tied. Each member carries a three-wire line, and the span between the poles is 110 metres. In France, simple iron flooring-sections have been employed, built-up supports being used only at corners and for "stay"-poles (see below). Concrete foundations are again used, and the maximum depth of the section is placed perpendicular to the line.

Comparing the general characteristics of the various types of supports available :—

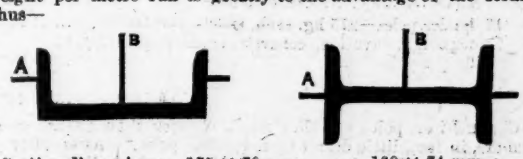
Wooden poles are cheap to install, but their maintenance is costly : their strength decreases rapidly with time, and underground rotting often results in unexpected disaster. The poles often break in the fourth or fifth year of their service, and fire and lightning invariably cause great trouble. The maximum permissible span is about 40 metres, hence the cost of insulators is heavy ; the insulating properties of the poles themselves form a very minor advantage.

Reinforced concrete poles are costly, heavy, and difficult to transport ; no accurate opinion can yet be formed of their durability and upkeep charges, but the many cracks which soon appear on their surface will probably result in serious ultimate deterioration of the iron framework.

Among all-metal supports, those of tubular form are dear and are liable to initial or developed defects from their hidden inner surface outwards. Such poles are mainly employed in towns, where their neat appearance, compact form and great strength commend their use. Lattice towers are costly, both in metal and in foundations, while the great bulk of the latter increases the difficulty of obtaining wayleaves over arable land. For their thorough preservation, the towers should be scraped before repainting, but the frequent neglect of this costly procedure enables extended rusting beneath the fresh paint. This possibility of considerable deterioration with time has been inadequately allowed for in many existing installations, and the past use of too light sections, often (for cheapness) poorly constructed, seems likely to cause much trouble in the future.

Channel-Iron Poles.—It is shown below that simple channel-iron poles possess many real advantages, though it is, as yet, too early to advance definite data concerning their mechanical durability. Trials with various rolled sections, and with various built-up combinations thereof, show that single ⊔ sections are the most economical for poles supporting straight lengths of line, and two such sections suitably cross-tied are best for strain-poles at angles in the route. This section is the most convenient, as regards both the erection of the pole itself and the attachment of insulators.

A comparison between ⊔ and H sections of the same weight per metre run is greatly to the advantage of the former. Thus—



Section dimensions...	175 × 70 mm.		160 × 74 mm.	
Weight per metre run (kg.) ...	17·8		17·9	
Mt. inertia (I_A) and mt. resistance (Z_A) (C.G.S. units)	105	20·4	56	15·04
Mt. inertia (I_B) and mt. resistance (Z_B) (C.G.S. units)	1,120	128	945	118

* Condensed abstract of article on this subject by G. Dothiollaz, "La Technique Moderne," 1911, pages 80—85.

The ⊔ section is clearly much more rigid than the other about axis A, and is hence less liable to fatigue itself, the insulator pins, and the binding wires by vibration in the wind.

In designing this type of pole, a maximum wind pressure of 30 lb. per sq. ft. may be assumed together with a surface coefficient of 0·57. The poles being designed to resist maximum wind pressure normal to the line, are found to be sufficiently strong to resist wind pressure parallel to the line. They then offer their maximum surface and minimum moment of resistance to the wind and, though the line conductors act as shrouds, pole to pole, there is some danger of a series of poles collapsing parallel to the direction of the line ("like a row of dominoes"); to avoid this risk, specially rigid "stay"-poles are placed at suitable intervals along the route. The deflection of successive poles between stay-poles becomes greater and greater (owing to the cumulative effect of wind pressure and altered sag of conductors in the adjacent spans), and the situation of the stay-poles is such that no simple pole is ever strained beyond the limit of its elasticity. In a certain 13,500-volt three-phase scheme, seven simple poles were placed between each pair of stay-poles (say two stay-poles per kilometre); the pitch pole to pole was 60 metres.

The general construction of plain and stay-poles respectively, is shown in figs. 1 and 2, while figs. 3 and 4 illustrate two types of "angle" poles which are used respectively according to the number of wires carried and the angle through which the route bends. The angle between the members of stay-poles (fig. 2) is much smaller than between those of "angle" poles (fig. 4), and is only

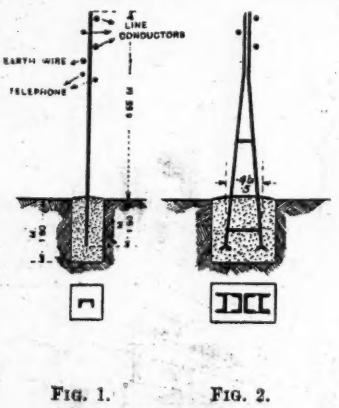


FIG. 1.

FIG. 2.

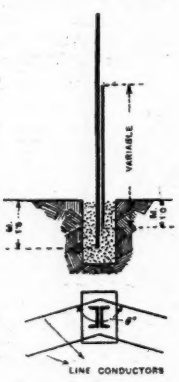


FIG. 3.

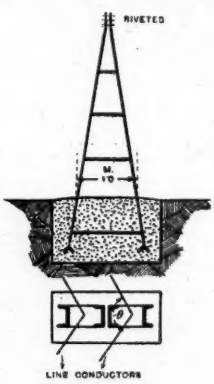


FIG. 4.

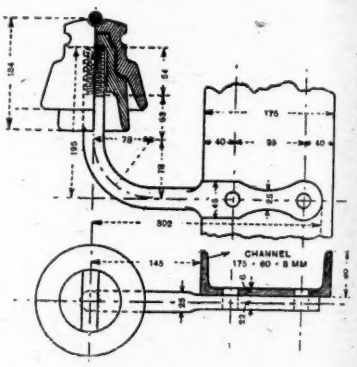


FIG. 5.

(three-wire line) is about 5,200 kg., including stay and angle-poles; the cost per km. of the structural iron, at a mean price of £1 per ton, totals £52.

Constructional Notes.—It is an easy matter to train competent workmen in the proper construction and erection of channel-iron supports, but we may again reiterate the elementary, yet oft-neglected injunction, to erect poles in the manner assumed by their designer, and strictly according to the route maps issued by the surveyors of the scheme. Thorough attention to the solidity of construction during installation is amply repaid by subsequent low maintenance charges.

The pole channels are despatched from the rolling mills (or head-quarters) ready drilled, with all the holes necessary to secure the insulators, and with a further series of ¾ in. holes at intervals of about 20 in. up the back of the section to facilitate the attachment of hoisting tackle, and (later) spikes, &c., to prevent unauthorised access to the line. Batches of poles are delivered to suitable depôts along the route, together with such tools (portable forge, punching press, drills, and so on), as are necessary to build up stay and angle-poles, and similar special local work.

The actual erection of the poles offers no difficulty, but it is important not to remove their mooring ropes till the foundation cement is thoroughly set, otherwise the poles will sway in the wind and become loose in their footings. (Since the stresses in the metal are proportional to the free projecting length of the pole, and the deflection of the line to the cube of this length, it is very important that no slackness should be set up in the foundations.)

A suitable concrete for the footings may be made by taking 420 lb. of medium-fast cement per cubic yard of gravel aggregate (the latter to be shaken through a 2-in. mesh). Successive layers of the concrete must be thoroughly tamped, and the whole should be covered by a conical or pyramidal cap of neat cement. The pole is dressed with red lead, and then receives two coatings of grey paint; for 2 ft. above and 1½ ft. below ground-level, a thick coating of coal-tar is applied as a protection against moisture.

required to give the structure additional resistance to wind pressure. In the arrangement of fig. 3, a channel-iron buttress (of height dependent on the load) is riveted back to back with the main pole, while in the construction illustrated by fig. 4 two inclined poles are riveted together at their summits, and cross-tied by suitable straps, as shown. To obtain the best utilisation of material, it is generally advisable to use for:—

3-wire lines { The arrangement of fig. 3 for θ° = 175°—105°
„ „ „ 4 „ θ° = 100°— 80°

6-wire lines { The arrangement of fig. 3 for θ° = 175°—145°
„ „ „ 4 „ θ° = 140°— 80°

COMPARATIVE COST OF CHANNEL-IRON POLES AND LATTICE TOWERS.

The comparative installation costs per km., of the supporting structures alone, for a three-wire line (13,500 volts pressure; three 80/10 power wires, two 30/10 telephone wires, and one 40/10 earth wire; pitch of supports = 60 metres) are as follows:—

Channel-Iron Construction.—	*Shillings.*
15 simple poles (fig. 1)—200 kg. each, at 18s. 2d. per 100 kg.	550
2 stay-poles (fig. 2)—550 kg. each, at 23s. per 100 kg.	253
Transport, excavation, concrete, erection and painting { 15 poles at 20s. each; 2 poles at 37s. each	300; 74
Total	1,177
Lattice (or Girder) Pole Construction.—	
17 lattice poles—275 kg. each, at 32s. per 100 kg. ...	1,500
Transport, excavation, concrete, erection, painting, at 36s. per pole	612
Total	2,112

Channel-iron poles are thus much cheaper than lattice towers, and are, in fact, little dearer than wooden poles.* After allowing for the angle poles, which are required in any long-distance transmission, the relative economic advantage of the above channel construction remains practically the same. Among several transmission schemes employing this construction, the average pitch, pole to pole, is 55—58 metres, and the weight of iron per km.

* Channel-iron angle poles may be employed with advantage on lines otherwise using wooden poles. Suitable iron supports are very little dearer, and are much stronger and more rigid than the braced wooden poles usually employed in such cases.

Insulators: Type and Mounting.—The type of insulator employed for 13,500-volt lines, and the manner of its attachment to channel-iron poles, are shown in fig. 5 (dimensions in mm.).

A 40/10 galvanised iron earth wire is employed, contact being secured to the pole at every tenth insulator by means of a lead ring.

The main conductors act as guy-wires, or shrouds, to the poles in the direction of maximum flexibility of the latter if, and only if, the conductors be well tied down to each insulator.

Great attention should be paid to the correct situation of the insulators when designing the poles, and, under the worst possible conditions, the insulators should be loaded well within their guaranteed capacity.

Conclusion.—Summarised, the advantages of channel-iron supporting poles for transmission line conductors include:—Economy, strength, easy maintenance, and small space occupied by foundations. Systems laid out on this plan, and for pressures exceeding 30,000 volts, have, during several years' operation, proved channel-poles to be suitable for all kinds of soil and for all contours of route; to withstand the most violent hurricanes and to be immune from any serious damage by lightning. Care must be bestowed upon their proper erection, but there are no real difficulties in their application.

With such a simple pole construction, it is clearly unnecessary to provide a factor of safety of 3—5, such as is required by wooden or complex metal poles. The standard channel-pole (for use on straight stretches of route) consists of a single bar of iron, and in its design it may be taken that the maximum possible load may stress the metal almost to its elastic limit.

Japan.—The Japanese Government is engaged in laying a submarine telegraph cable between Kajafuto and Hokkaido.

NOTES ON ELECTRIC STREET LIGHTING.*

By L. Crouch.

Of recent years, particularly since the advent of the flame arc and the metallic filament lamps, the use of electric lamps for street lighting has greatly extended. At the present day the electrical illumination of streets forms so important a part of the illuminating engineer's practice and so important a part of the central-station load as fully to justify the following notes dealing with the peculiarities of the service in question, the results to be attained, the various types of lamps at the disposal of the illuminating engineer, their characteristics and relative values, and with the general arrangement and equipment of street lighting schemes and the annual costs thereof.

Units and Formulæ.—The units concerned in the problems of street lighting are few in number; the chief of them, in the English and metric systems, and the relationships between them, are :—

Length.	Area.
Foot and metre.	*Sq. foot and sq. metre.*
1 foot = 0·3048 metre.	1 sq. foot = 0·0929 sq. metre.
1 metre = 3·28 feet.	1 sq. metre = 10·79 sq. feet.
Luminous Intensity.	**Illumination.**
Candle Power and Hefner.	*Candle-foot and Lux.*
1 English C.P. = 1·11 hefners.	1 candle-foot = 11·75 lux.
1 hefner = 0·90 C.P.	1 lux = 0·085 candle-foot.

The only formula at all extensively used in street illuminating engineering is that expressing the horizontal illumination at a given point h feet below the source and r feet horizontally displaced from it; the candle-power of the source in the direction of the point concerned being C.P., the illumination at the latter is given by

$$I = \frac{\text{C.P.}}{h^2}\left(\frac{1}{\left(1+\frac{r^2}{h^2}\right)^{\frac{3}{2}}}\right) \text{ candle-feet.} \quad \ldots \quad (1)$$

As will be readily understood from the following sections dealing with the factors (many of them very indeterminate) which influence the actual illumination at a given point, even this equation must be used with the greatest caution and with a very definite admission of its practical limitations (see also text comments on fig. 5).

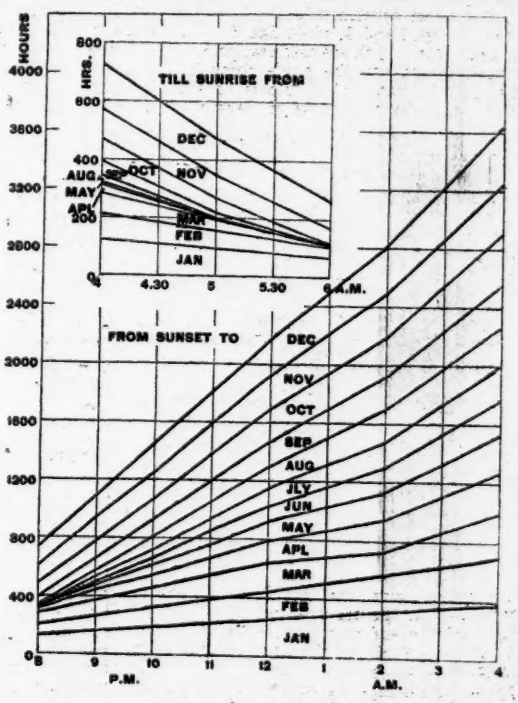
Nature of Duty.—The main problem, in street lighting, is to illuminate sufficiently and as uniformly as possible a narrow and indefinitely long area. Economy is a vital consideration throughout; maximum illumination of a suitable nature must be obtained at minimum expense, and this without making the luminous sources at all obstructive or inconvenient to traffic or to the eyes.

How often, for instance, is there found in small towns a row of lamps so placed that the net effect of the line, which sinks to the horizon by perspective, is to dazzle the eye and almost entirely prevent the seeing of any obstruction till the latter is within a few yards. Such results should be rigorously avoided; in the above particular case, the obvious remedy is to suspend the lamps at a greater height.

Main and side streets must be discriminated in planning an illumination scheme. The fact that main streets being more frequented and having denser road traffic require, if only for reasons of safety, from 3 to 5, or even 7 times, the mean illumination which amply serves outlying streets, is often neglected. The result is a uniform murky gloom in what might, with little extra expense, be a proportionately and efficiently illuminated district. The illumination of every street should be determined by local conditions and needs. As a rule, the whole of a street lighting installation is switched "on" at sunset and "off" at, say, 3 a.m., but in some cases one section may be lighted considerably earlier or retained in circuit later than another, and so on, the recent arrangement of arc lamp circuits in Cheapside being a case in point. Again, various districts may be switched "on" *en bloc* from the central station or from a limited number of feeder points, or every lamp standard may be provided with its own switch.

The number of "burning hours" per year—a factor of considerable importance when estimating annual costs—for various running arrangements is shown in figs. 1 and 2.

Inherent Advantages of Electrical over other Methods of Street Lighting.—As already mentioned, one of the most important criteria of any proposed lighting system is operating economy. In many instances electric street lighting can show undoubted economic superiority over the most formidable of its rivals, which is, usually, the high-pressure



Figs. 1 and 2.—Burning Hours per Annum

"incandescent" gas system. In other cases, the economic superiority is less marked, or, possibly, altogether absent. These economic relationships are invariably so complex as to need full individual examination in every case; generalisation in this matter is very difficult, but, given tolerably average conditions and reasonably cheap electrical energy and gas supply—

1. Flame arcs can more than hold their own, even against the best high-pressure incandescent gas system.
2. Ordinary or enclosed arcs can displace low-pressure incandescent gas.
3. Incandescent metallic-filament lamps can displace low-pressure incandescent gas lamps and small arc lamps.
4. Carbon-filament lamps can seldom be economically substituted for incandescent gas or small arc lamps.
5. "Patent" gas lights, though excellent in themselves, are of limited application, and, under normal conditions, coal gas or some form of electric lighting is preferable.
6. "Fish-tail" burners, oil lamps, &c., are economically obsolete.

Among the general advantages of electric street lighting are :—Less susceptibility of luminous source to damage by wind, rain, &c., greater permanence of candle-power, superior cleanliness and absence of leakage, ease of control and general flexibility, and, excepting in arc systems, low renewal and attendance costs.

Perhaps the best practical evidence of the economic possibilities of electrical street lighting is given by the continually recurrent contracts which undertake the complete supply and maintenance of such a system as will give a certain minimum street illumination. The prices for electrical

* Since the MS. of this article was received, Mr. Harrison's paper has been read before the Institution of Electrical Engineers, giving a number of operating data regarding various electric lamps used for street lighting. The article, which purports to present a general review of the subject, including various standard data commonly required, and a considerable number of original figures showing the average values of various factors met with in practice, has been revised in the light of Mr. Harrison's and other publications, and may be relied upon as a guide to present-day practice.—Eds. E.R.

operation by flame arcs, are more and more frequently the lowest received. The recurrence of such tenders and their profitable working prove that they are not mere "business catchers" run at a loss for the sake of encouraging subsequent orders. Unfortunately these remarks cannot be applied to many gas-lighting tenders. For instance, the circumstances attending the adoption of gas lamps in Westminster and other London areas will be familiar to all readers.

Types and Characteristics of Various Electric Lamps used in Street Lighting.—The classes of lamp which need be considered in the present connection are :—

1. Arc lamps—open, enclosed and flame.
2. Nernst lamps.
3. Metallic-filament lamps.
4. Carbon-filament lamps.

The characteristics which require comment in each case are :—

1. Ability to withstand the mechanical severity of the service.
2. First cost, life and attendance charges.
3. Colour of light, luminous efficiency, candle-power of units, constancy of C.P.
4. Intrinsic brightness of source, spherical reduction factor and nature of polar distribution curve.

1. *Arc lamps* as at present constructed are quite suitable for street service so far as concerns mechanical strength of the whole and robustness and reliability of mechanism. The first cost of arc lamps is unfortunately high, and for all candle-powers up to about 600 C.P. metallic-filament lamps compare favourably in this respect, and are likely to become yet cheaper as the demand increases. The information contained in Table I is valuable in this connection :—

TABLE I.*—Prime Cost of Various Lamps With and Without Accessories.

Type of lamp.	C.P.		Cost of lamp alone = A.		Cost of lamp + accessories = B. †		A / C.P.	B / C.P.
			£ s. d.	Pence.	£ s. d.	Pence.	Pence.	Pence.
Open arcs, D.C.	1,000		4 10 0	1,080	5 15 0	1,380	1·08	1·38
,, ,, A.C.	1,000		5 0 0	1,200	6 10 0	1,560	1·20	1·56
Enclosed arcs, D.C.	600		5 0 0	1,200	6 0 0	1,440	2·00	2·40
,, ,, A.C.	600		5 10 0	1,320	6 10 0	1,560	2·20	2·60
Flame arcs, D.C., A.C.	3,400		8 0 0	1,920	11 0 0	2,640	0·56	0·77
	No. of lamps.	Total C.P.						
Carbon filament	2	200	0 12 0	144	1 12 0	384	0·72	1·92
,, ,, ...	2	100	0 6 6	78	1 6 6	318	0·78	3·18
,, ,, ...	2	32	0 2 6	30	0 17 6	210	0·94	6·58
Metallic carbon	2	64	0 4 0	48	1 4 0	288	0·75	4·50
,, ,, ...	2	32	0 2 6	30	0 17 6	210	0·94	6·58
Nernst	½ A.	66	0 7 6	90	1 0 6	246	1·36	3·73
,, ...	1½ A.	330	1 10 0	360	3 0 0	720	1·09	2·18
,, ...	3 A.	820	1 15 0	420	3 10 0	840	0·51	1·02
Tantalum	4	200	0 14 0	168	2 4 0	528	0·84	2·64
,, ...	8	400	1 8 0	336	3 8 0	816	0·84	2·04
Tungsten	1	400	1 2 6	270	2 12 6	630	0·68	1·58
,, ...	1	300	0 17 6	210	2 2 6	510	0·75	1·70
,, ...	1	200	0 12 6	150	1 12 6	390	0·75	1·95
,, ...	1	100	0 7 6	90	1 2 6	270	0·90	2·70

* The cost of accessories depends largely on individual circumstances, but costs A are more generally applicable. The accessories of arc lamps include line resistance, cut-out coil, &c. ; the globe and other lamp fittings are included in A. The accessories of the filament lamps include holders, reflectors and a suitable lantern. The cost of posts is *not* included above in any case.

† Since preparing this table, it has become possible to obtain metallic-filament lamps at 20 to 30 per cent. lower prices than those shown.

From this table it appears that the cost per C.P. of any commercial type and size of electric lamp lies between ½d. and 2d., but when the cost of accessories is allowed for, the range of variation is much extended, and the total cost per C.P. for low candle-power units becomes disproportionately heavy.

The life of arc lamps themselves cannot yet be determined accurately ; so far, it has simply resolved into the gradual *obsolescence* of older types and their replacement by *more efficient* patterns. Probably a life of between 10 and 20 years could easily be attained. The attendance charges are naturally heavier for arc lamps than for any other type, but the recent developments in magazine lamps have greatly reduced this item.

(To be continued.)

THE LONDON AND LOCAL UNIVERSITIES.

By A UNIVERSITY LECTURER.

London has a teaching University. Of that fact the average Londoner is supremely ignorant. The University of the Metropolis does not bear the same relation to the locality that is apparent with the Universities of Birmingham, Manchester and other provincial cities. The London University is a kaleidoscope ; there are many fragments, but there is little cohesion. Let us examine the question of University education for engineers in this country in general, and the special problem of London in particular.

At the present time there are two essentials necessary before the citizens of the greatest city that the world has ever seen will take any interest in the London University. One is the driving force of money, the other is a definite University policy. The two are really interdependent. If once the enthusiasm of the Londoner could be roused, money would be supplied. The metropolis is wealthy beyond computation. It is the hub of the financial world. It is the home of the City companies, which have done so much for technical education. A definite and constructive policy is needed.

The present senate of the University is an unwieldy body. Among its 56 members, the only names known in engineering work are those of Sir John Wolfe Barry, Dr. R. M. Walmsley and Dr. Cormack. Fourteen members hold medical degrees. The Faculty of Engineering has *one* official representative (Dr. Cormack). Sir John Wolfe Barry is nominated by the Crown. Dr. Walmsley represents Science. As a contrast to the *one* official representative of engineering, there are *nine* official medical representatives. The Royal College of Physicians and the Royal College of Surgeons have each two official representatives. The Institutions of Civil, Electrical and Mechanical Engineers are not represented. Among the 27 Fellows of the University there is no name well-known in technical circles.

London is not a city—it is a province, even a whole nation. An Act of Parliament gives the Senate of the University jurisdiction over a radius of 30 miles, an area of 2,830 square miles. There are over seven millions of inhabitants in this area. Ninety-five per cent. of the homes are maintained on income less than £1,500 a year. Scotland, with its population of some five millions, maintains four ancient and successful Universities. Engineers know of the Glasgow University—Watt, Rankine and Kelvin worked there. Ireland, with about half the population included in the district of the University of London, has

her several Universities. Holland and Belgium, countries of less wealth and fewer responsibilities than our Empire city, have half-a-dozen Universities for about the same numbers. Paris and Berlin draw from much smaller local populations, and exposed, each to the competition of a score of local and flourishing Universities, have as many as 12,000 students at each University. In London we should have at least 25,000 undergraduates.

Like the universities of fifteenth-century Europe and twentieth-century America, the London University must be more or less a technical school for the brain-working professions. You will never skim the "cream of society" for undergraduates in London; Oxford and Cambridge will always attract the wealthy. You will, however, attract the workers, the ambitious young men who want to "get on." You may even notice that the primary instinct of the young Londoner is to choose the "bread-and-butter" studies. Democracy demands, nowadays, equal opportunities for higher education with the wealthy. Your typical young Londoner means to get good value for his fees. Democracy is supplying, curiously enough, an intellectual aristocracy of advanced students.

London presents a wonderful opportunity for a great University. All of the learned and technical societies meet in London. The Royal Institution lectures, the Cantor lectures, the Kelvin lecture, the James Forrest lectures—all of these special efforts by the picked lecturers in applied science of the learned societies are given in London. Think of the work which has been done in the Metropolis, under the most uninspiring circumstances, so far as the University is concerned. Davy and Faraday, Daniell and Wheatstone, Hopkinson and Siemens—these names are surely well known to readers of this journal. If you care to go outside the profession of electrical engineering you can call to mind Huxley, Tyndall, Spencer, and other intellectual giants who have done great work. For half a century University and King's Colleges held aloft the torch of learning in London, and, despite their terribly inadequate financial resources, accomplished wonderful results.

Applied science is now a University subject; engineering is a profession. For good or evil—almost certainly for good, because it means progress—we must accept that fact. A University degree is not a professional qualification, but it is a thing to be obtained by the ambitious. The phrase "electrical engineer" is too cosmopolitan. The letters "A.M.I.E.E." at present mean little—they are obtained too easily. Whatever the practical man may say to the contrary, the letters B.Sc. represent a certain standard of ability. Dr. Fleming has recently attacked the details of the final examination, apparently because electrical engineering is not made a compulsory subject. Of course, it is possible to improve any syllabus, but it is a mistake to overload the candidate with many subjects.

Every young Londoner who wishes to become an engineer, as distinguished from a mechanic, should be encouraged to take the B.Sc. degree. The Board of Education certificates are too easily obtained in the elementary subjects. The writer has often thought that the Board should institute some definite and general certificate, like the Board of Trade certificate for marine engineers. At present the B.Sc. is the one standard in this country by means of which we may be sure that a man knows the general principles of technology.

The subjects of science and engineering are "bread-and-butter" studies, and should be, without doubt, the strongest side of the London University. There are engineers who say that technology is leaving the Thames, and that the provincial Universities must train the Londoner in applied science. But there are thousands of parents in London who cannot afford to send their sons to board in another town; there are also many who shrink from sending the lad of 16 away from home influences. London is still a great manufacturing city, for one-seventh of the industrial population employed in the factories of England and Wales are in the metropolis.

At present the facilities for training are woefully inadequate. The machine is cumbersome, and is worked in a ludicrously inefficient manner. The professor who does research work worthy of discussion before the Institutions of Electrical or Mechanical Engineers, or the Royal Society, must, under existing conditions, teach the tired apprentice the elements of magnetism and electricity in the evening.

The London Colleges in which technology is taught are fairly numerous, but quite inadequately equipped. The Imperial College, thanks to the generosity of the City Companies, probably possesses the finest experimental plant. It is to be improved, but at present it is right behind that at Birmingham. King's College might, with advantage, have £50,000 spent on its engineering buildings and equipments, and a like sum could be spent at University College on applied science developments. The huge Eastern district requires an active centre of higher teaching and research in engineering. London can never be content with one centre of higher education; travelling takes too much time for that to be possible.

The destiny of the Polytechnics is clear. They should be multiplied and be supported locally. They should offer facilities for the numerous undergraduate class. While their teachers should have sufficient leisure for research work, these institutions should be, primarily, *teaching* centres. They should provide the poor man, at low fees, with the opportunity of obtaining the degree.

The whole of the engineering work in connection with the University requires to be separated from the existing Senate. Dr. Glazebrook has outlined a scheme of development which would mean that the applied-science side of the London University would flourish. We want to have the business men of the metropolis interested, and that could be obtained by the establishment of a separate technical faculty which should have powers to confer degrees under conditions laid down by the faculty. Business men and engineers practising should be on the Faculty Council.

The University of London is unique, because no matter where a student works, he may obtain the London Degree by passing examinations. He may be a pit lad in Yorkshire, or a shopkeeper in Calcutta. Provided only that he can pass the examinations, he can obtain the degree.

Apart from the University of London, there are two main types of University in England—the "island University" and the "city University." In the one case the University has no close relation with the people of the district. In the other case it is an integral part and exercises a great influence upon the local community. Oxford and Cambridge are governed by their graduates and teachers—the Universities of the manufacturing cities are governed by Councils, the majority of whom are citizens. That is the American system. The President of Columbia University, New York, recently said in London, when speaking of the Board of Trustees or Council of his own University, "Membership on the Board is considered, and has been considered for 150 years, to be the blue ribbon in the public life of New York"; and a seat on the Council of the University of London ought to be the blue ribbon of London public life.

The following figures show the support which is given to the local Universities of this country. The Owens College, which has developed into the University of Manchester, has increased its capital sum of £100,000, left by the founder, to over £1,000,000. The University of Liverpool has received a grand total of over £800,000 since its formation. The readers of this journal know of the palatial buildings and equipment of the University of Birmingham. In London the new Imperial College has obtained very great financial support—but then, it is governed by business men. It is, of course, a school of the University of London, although financially separate.

More than 500 students in engineering are at present working in the London colleges for the degree. If we average out that another 300 in the provinces and abroad are also working for the (external) degree, we arrive at a total of 800. Add to this an average of 100 applied science students at each of the Universities of Manchester, Liverpool, Leeds, Sheffield, Birmingham and Bristol, and we have a total of 1,400 students, the majority of whom will graduate (B.Sc. Engineering) during the next three years.

This year there is to be a congress in London on higher technical education. If engineering is a profession—and most engineers claim that—these examinations are necessary for entry to the profession. The system is not ideal, but it passes the wit of man to devise a better. Enormous increase of status has resulted to the Institution of Civil Engineers

from its entrance examination. Mr. E. B. Ellington recently hinted at one for the Institution of Mechanical Engineers. There may be a good reason, but it is difficult to understand why the Institution of Electrical Engineers has not made compulsory an entrance examination. If these things come about, they will influence the Applied Science University degree. In the meantime, there is no use in disputing the fact that the younger generation of engineers are going direct from school to the Universities because, presumably, their parents imagine engineering to be a profession.

PROCEEDINGS OF INSTITUTIONS.

The Driving of Winding Engines by Induction Motors.

By H. J. S. HEATHER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 11th*, 1911.)

THE author points out that D.C. plant has usually been employed for hoisting and winding work, even on a polyphase system of supply, in preference to the less costly direct-induction motor drive, in consequence of the waste of energy in the rheostatic control of the latter, and the difficulties due to the relations between torque, speed and resistance in the secondary circuit of the induction motor. Tests carried out by him on a three-phase winder in 1906 convinced him that the first of these objections was groundless, and that if the control of the motor could be made as safe and simple as that of the D.C. motor of the Ward-Leonard set, the auxiliary machinery being eliminated, the direct three-phase drive would be the more reliable.

Mr. Heather proceeds to review the Ward-Leonard system of control, which he shows is of the utmost simplicity, and has the great inherent advantage of being regenerative.

With induction motors, as in the case of D.C. motors with rheostatic control, a definite torque at a speed between full speed and zero can only be secured by using the full power that would correspond to it at full speed.

When lowering loads the D.C. motor can be used as a generator, absorbing the energy generated in resistance; alternatively, it can be left connected to the mains, taking the current corresponding to the desired torque, and absorbing in resistance the power represented by this current as well as that produced by the hoisting motor acting as a generator—a total about twice as great as the full normal output of the motor. The action of the induction motor when lowering is almost exactly similar to the latter method; it is equally simple and equally wasteful. But as practically all heavy transmission work is done on the three-phase system, the D.C. motor with rheostatic control requires the addition of some form of converter, and therefore the induction motor drive is preferable.

The characteristics of the induction motor controlled on these lines are then investigated, and the conditions met with in hoisting and lowering loads are considered. To avoid the complications introduced by running the motor above synchronous speed when lowering, or using a two-speed motor, for the sake of regeneration, the author prefers to use the reverse current, as explained above, and to face the losses, which are unimportant, when there is not much lowering to do.

An objection which has been advanced against the use of the direct induction motor drive is that it is difficult for the driver to know whether he has to increase or decrease the resistance in the secondary circuit in order to increase the torque. This can be overcome by using an ammeter as a torque indicator. To all possible torque-speed curves there is only one torque-ampere curve, and so long as a definite maximum value of current is not exceeded, the torque is always increased by increasing the current, as in the Ward-Leonard system. The polarised ammeter used with the latter also indicates the direction of the running of the motor; a similar indication can be readily provided in the case of the induction motor by using a special ammeter with two windings, which are respectively brought into circuit so as to deflect the common needle to one side or the other in accordance with the direction of rotation of the field in the stator of the motor, and therefore the direction of the torque. The control of the operations then becomes as simple as in the case of the Ward-Leonard system, and the movement of the controlling lever is also almost precisely similar in kind, though not in extent.

An emergency brake, available in case of failure of the external supply, is provided by the excitation of the stator with direct current, and absorbing the energy then generated by the rotor during braking, in a resistance. The change-over can be effected automatically on the failure of the supply current.

The author concludes that although his proposals are more expensive in power consumption where much lowering has to be done, they embody arrangements which are superior to those of the Ward-Leonard system as regards simplicity and safety. Inasmuch as the cost for the simple induction motor is lower than that for a Ward-Leonard set, he considers that he can at least claim that where cheap power is obtainable from a large power plant and capital outlay is a consideration, he has made out a case for the induction motor.

DISCUSSION.

MR. PATCHELL, who read the paper in the absence of the author, mentioned a case in South Africa, which had come to his knowledge, where a large number of induction motor-driven winders, of from 400 to 1,500 H.P. each, were being installed, and it was considered possible that £50,000 would be saved by adopting them instead of Ward-Leonard winders.

MR. W. C. MOUNTAIN said that any system of winding which did away with the Ilgner complications would constitute a great advance, and add to the popularity of electric winding. The case must, however, rest on practical results. There was a large field for the small geared winder, especially in the North of England, if a suitable supply of power were available. With even a large station, the peak loads of a winder were felt, and he instanced the case of a 700-H.P. induction motor-driven winder run direct off the 5,500-volt mains of the Newcastle E.S. Co., which during acceleration took up to 1,700 H.P., a load which, when it came on, could always be observed in the company's power station. Taking the particular case of a winding gear of moderate size, which was in considerable demand, a comparison of the power required showed a maximum of 440 H.P. in each case for acceleration, but with the Ilgner system the maximum input from the power station was only 210 H.P., or about half the input for the induction motor direct drive. Actually, however, the total energy consumption was in favour of the induction motor drive, viz., 2·3 units per wind, against 2·7 units for the Ilgner winder, this being due to the constant running and losses in auxiliaries in the latter case. There was some risk with the Ilgner apparatus owing to the number of links in the chain open to failure, and he knew of an Ilgner winder in the North of England which had been laid off for six weeks through an accident to a balancer motor. In case of failure of the balancer it should be possible to operate the motor direct; in the case of induction motors the windings should be for low voltage and designed for easy repair, and with a transformer to reduce the voltage, the cost would not be much increased.

MR. STJERNBERG, who criticised the induction motor wind, said that the smaller the ratio of average speed to total time, the easier it was to arrange electrical winding gear. As the ratio increased the efficiency dropped off, slowly in the case of the Ward-Leonard system, and quickly for the induction motor drive. With the Ward-Leonard system there was no connection to the main circuit; it was a mechanical arrangement and was very safe; with the other system there were resistances and contacts to get out of order.

MR. GERALD STONEY said there was a perceptible fluctuation at Carville, even with a load of 30,000 KW., when the 700 H.P. winder at Harton colliery came on or went off. No doubt there would be serious fluctuations if several winders of this kind were on the mains. The simple winder, such as the above, cost about £1,100 as against £1,600 for an Ilgner winder. He suggested that if four cages were used with induction motor winders, it would be possible to run them so as to even up the fluctuations.

MR. PATCHELL, in reference to one or two matters raised in discussion, said it depended where the supply of energy came from as to what kind of winder would be adopted; in the case of a private generating station, the Ilgner winder would economise plant. Mr. Heather, of course, bought from the Victoria Falls Co., and possibly the peaks did not matter to them; he had heard from a friend in South Africa, who had a Ward-Leonard winder in use, that he was installing an induction motor-driven winder which would take 3,000 H.P. peaks in 80-sec. winds, but in this case the power company viewed the matter with equanimity. The direct-coupled A.C. winder had an advantage for stage winding, on account of the small space required. The swing of the balance rope with steam drive had set English colliery engineers against balance ropes; the electric winder, however, obviated the swing altogether. There was the chance of sparking at resistance contacts with the induction motor-drive, whereas both the Ilgner and Ward-Leonard systems were free from this.

Some Studies of Welds.

By E. F. LAW, W. H. MERRETT and W. POLLARD DIGBY.

(*Abstract of Paper read before the* IRON AND STEEL INSTITUTE, *May*, 1911.)

THE authors define the term weld as applied in this paper as consisting of an actual fusion together of similar or allied metals.

Their investigation of resistance welds in steel commenced with round and rectangular bars, welded together with plain butt joints. The welds generally may not be regarded as perfect from the point of view of fusion, but as showing traces of oxidation along the track of the weld. In this area any corroding medium has a pronounced effect, and these results confirm the view put forward by one of the authors in 1907 that the existence of an oxide of iron in steel is a source of corrosion.

An etched section from a 2½-in. × 2-in. bar shows the extrusion of metal at the point of juncture due to the pressure applied along the horizontal axis of the bars. The fusion of the metal is perfect. The increased crystallisation due to heating would disappear with annealing.

The extruded metal takes the form of bands bulging from the centre of the weld.

The fracture due to the normal welded metal was of a silky fibrous nature, and could be distinguished from the crystalline fractures of the welded lengths.

Whereas 3C, the test-piece from the unheated portion of the billet, shows a good normal mild steel, specimen 2A is the only one

which can be considered fairly good, and it would have been improved by working and annealing. The other specimens with elongation of 4 per cent. on 2 inches, and average tensile strengths of 17·03 tons per square inch, and elastic limits averaging 13·01 tons, all serve to indicate that for welds of this character it is not sufficient to be content with the excellent fusion of the metal obtained, but that the working which is also requisite in hot-flame welds is, in addition to annealing, equally advisable for this class of work.

TABLE I.—TENSILE TESTS OF RESISTANCE WELDS ON 2½-IN. BY 2-IN. BARS, WITH BUTT JOINTS.

Weld No.	Breaking strain. Tons per sq. in.	Elastic limit. Tons per sq. in.	Elongation on 2 in. Per cent.	Reduction of area at fracture. Per cent.	Remarks.
2A	24·73	16·22	15·00	31·25	Broke at weld. Fracture mainly crystalline.
2B	19·55	14·85	5·00	8·97	Splintered fracture. Slight crystalline area.
2C	27·30	20·27	35·00	65·70	Original steel. Normal fracture.
3A	16·42	13·95	4·00	7·61	Splintered fracture. Slight crystalline area.
3B	12·60	9·30	3·00	4·33	
3C	26·52	18·68	34·5	63·30	Original steel. Normal fracture.
BA	17·55	14·42	4·00	12·09	Splintered fracture.
BB	27·10	20·05	33·00	65·60	Original steel. Normal fracture.

TABLE II.—TENSILE TESTS OF RESISTANCE WELDS ON 1½-IN. ROUND BARS, WITH BUTT JOINTS.

Weld No.	Breaking strain. Tons per sq. in.	Elastic limit. Tons per sq. in.	Elongation on 2 in. Per cent.	Reduction of area at fracture. Per cent.	Remarks.
4A	28·10	21·07	10·00	12·40	Crystalline fracture, over-heated.
4B	21·82	19·50	3·50	5·34	
4C	26·95	18·00	35·00	63·70	Original steel. Normal fracture.
AA	27·65	20·15	37·00	63·30	
AB	25·70	20·65	12·00	13·65	Crystalline fracture, over-heated.

The test-pieces 4C and AA from the unheated portion of the bar indicate a good normal mild steel. The remaining results, which embrace the area of the weld but do not embrace the extruded metal, give appreciably higher tensile strengths of 25·20 tons, with an elastic limit of 20·4 tons, and are better than the test-pieces from the rectangular bars. The irregular and poor elongations average 8·5 per cent., and the crystalline fracture, which has resulted from the overheating, indicates the value of annealing as a necessary corrective.

Perhaps the best examples of successful resistance weld were found in a number of links of a chain made by this process. On etching, each link showed crystallisation adjacent to the weld. The very effective working given while the link was still plastic prevented any tendency to extrusion of metal.

Various examples of acetylene welding passed through the hands of the authors.

The average tensile strength of 24·14 tons and the average elastic limits of 17·01 tons are both fairly good. On the other hand, the low elongation and percentage reduction of area which accompany the crystalline fracture of the last two of the above results indicate that, in addition to working, some further heat treatment was requisite.

TABLE III.—MECHANICAL PROPERTIES OF ACETYLENE WELDS (BUTT JOINTS).

Breaking strain. Tons per sq. in.	Elastic limit. Tons per sq. in.	Elongation on 8 in. Per cent.	Percentage reduction of area.	Remarks.
26·24	19·50	12·50	50·60	Test-piece broke not at weld. Fracture silky fibrous.
26·90	18·88	15·60	52·80	
21·57	14·00	6·26	10·08	Fracture at centre of bar. Crystalline fracture, broke at weld.
21·74	15·66	4·38	2·43	

Another process in which acetylene is employed for welding boiler plates deserves mention. The plates are shaped to a blunt vee end, and the weld effected by melting Swedish iron in the depressions on either side. On etching a section of a weld prepared by this process, the iron and steel areas were shown to be quite distinct. The authors would regard this process as a good filling method, say for cavities in castings, but could not recommend it seriously for cases where mechanical strength is of prime importance.

TABLE V.—MECHANICAL PROPERTIES OF WATER-GAS WELDS (SCARFED JOINTS).

Breaking strain. Tons per sq. in.	Elastic limit. Tons per sq. in.	Elongation on 8 in. Per cent.	Percentage reduction of area.	Remarks.
22·05	14·76	17·80	59·20	Broke not at weld.
21·10	14·38	18·75	36·40	Broke at weld. Laminated fracture.
19·83	12·92	6·26	56·70	Broke near end of bar.
22·91	16·73	23·75	64·60	Broke not at weld.

With water-gas welds the average tensile strengths and elastic limits of 21·47 tons and 14·69 tons respectively are lower than the results for plain butt-welded joints with acetylene flame heating. On the other hand, whereas two of the four acetylene welds in Table III broke at the weld, only one of the four water-gas welds in Table V broke here. The elongation is much better, averaging 16·64 per cent., and the reduction of area at point of fracture is decidedly good. The welds given in Table V are abnormal owing to the use of an oxidising flame.

Strictly speaking, the Thermit process is a fusion, rather than a welding process. Generally the process, yielding, as it frequently does, a spongy mass of metal with blow-holes, is useful mainly as an emergency process.

For a long time certain consulting engineers have rigidly set their faces against the employment of welded flanges on steam pipes, preferring instead screwed and riveted flanges. Two cases (one a coke fire and the other an arc weld) coming before the authors, serve both to confirm and to illustrate the underlying soundness of this view. A welded pipe flange may be superficially perfect, and capable of passing hydraulic pressure tests. In this latter condition, ignorance as to its internal condition produces a peace of mind which knowledge is liable to destroy.

In the case of the coke-fire weld, there was no fusion of the metal; this was only nominally welded.

In the case of an arc-welded flange on a steel pipe, the welding was only partial, upwards of one-third of the area of junction having an air space. In its entirety, this pipe would have passed all reasonable hydraulic pressure tests, and its defects would only be discovered on service.

The fused metal was found to be very strongly magnetised, and to contain a large quantity of the magnetic oxide of iron, Fe_3O_4. Regarded as a method of welding, it is evident that arc welds cannot be relied upon to unite the entire area of contact in cases of this character, while the magnetic oxide formed renders the fused metal, upon which we have to rely for mechanical strength, peculiarly subject to corrosion. At least one case is known in which a consignment of pipes separated from their flanges owing to the action of atmospheric corrosion only.

No matter what the process is by which two metals are welded together, there must always be an area, more or less sharply defined, of altered molecular construction. Each of the methods to which the authors have referred has its own mark. For instance, on polishing and etching alone it is possible to say whether an electric weld has been made by an arc or by a resistance method; while, without annealing to restore the original structure, acetylene and water gas welds have each their own marked characteristics.

Resistance welds are seemingly least prone (with the exception perhaps of acetylene welds) to oxidation, but the extrusion of the metal renders good working, while the metal is still plastic, of supreme importance. Arc welds are most prone to oxidation, and many will hesitate to rely upon such a process in those positions where corrosion is likely to occur. Where the welded metal is not likely to be subjected to corrosion, the excellent fusion of the metal renders it commendable.

Flame welds, apart from such work as patching-up castings, should receive adequate working and manipulation while in their heated condition. Of the two methods investigated, water-gas welds may be abnormal through the use of oxidising flames, while acetylene welds certainly require annealing to break down the crystalline structure in the vicinity of the weld.

The difficulties to be obviated in successful welding may be said to be:

1. Too low a temperature to secure true fusion of the metal.
2. Oxidation of the metal at the point of welding.

Of these, the former can be detected more easily than the latter, which is more insidious in its results. The processes dealt with in this instance, and doubtless others not touched upon, can always be manipulated so as to secure true fusion. Excepting with arc methods of welding, oxidation can be avoided by the other processes studied by the authors in the preparation of this paper.

The Benkö Primary Battery and its Applications.

By W. R. COOPER, M.A., B.Sc., Member.

(*Abstract of Original Communication to the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE Benkö cell is due to the Hungarian engineer, Stephan Benkö, and depends essentially on the idea that if the layer of electrolyte on the positive plate (that is, electro-negative element) is removed as fast as polarisation sets in, the E.M.F. will be maintained constant. The means usually adopted for removing polarisation, which is responsible for most of the trouble in primary cells, are rarely quite

effective. The user would not object so much to polarisation in itself if it would remain sensibly constant, but this is seldom the case. The remedy adopted by Mr. Benkö is to use a carbon electrode sufficiently porous to allow the electrolyte to flow through it, thus continually providing a fresh supply to the surface that is tending to polarise. By so doing not only is very effective polarisation obtained, but for a given current the polarisation remains quite constant provided the cell is not overloaded.

For the sake of clearness the construction is indicated first diagrammatically in fig. 1. The carbon is shown at C, and is best described as a flattened cylinder open at both ends. The hard

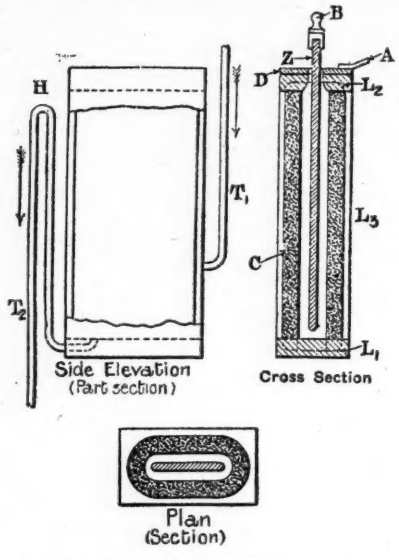


FIG. 1.—DIAGRAM OF BENKÖ CELL.

surface of this carbon, as received from the carbon makers, is removed by scratch-brushing so as to leave it easily porous. The carbon is then provided with a lead cap, L_1, at the bottom, and a lead ring, L_2, at the top, thus providing a vessel open only at the top. To obtain perfect contact between the carbon and the lead, the latter is put on under pressure, and the lead penetrates thoroughly into the pores of the carbon.

A lead shell, L_3, of sheet lead, 1 mm. to 1½ mm. in thickness, is then fitted round the carbon, leaving a small space between the carbon and the shell, and is jointed autogenously to the lead cap at the bottom and the lead ring at the top, so as to form a chamber all round the carbon. The outer chamber is provided with a tube, T_1; and a second tube, T_2, is fitted to the lead base, and is carried through to the inner chamber. This latter tube is carried up and bent over, and there is a small hole, H, at the top of the bend. Finally, a copper plate, D, corresponding with the lead ring, is soldered on to the lead, and forms one terminal, A, of the cell.*

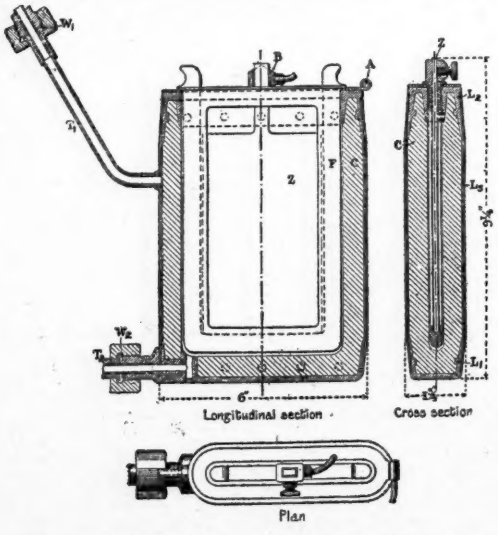


FIG. 2.—SINGLE BENKÖ CELL (STANDARD TYPE.)

The zinc, Z, is inserted into the inner chamber, and carries the second terminal, B. When in action, the electrolyte is delivered by the lead tube, T_1, into the outer chamber, whence it percolates through the carbon to the zinc: it then flows off through the lead tube, T_2, the form of which maintains the level constant within the carbon. As there is a hole at H, siphoning does not occur, though this may be made to take place by closing the hole with a finger for a few minutes. This is often convenient when it is desired to empty the cell. It will be noticed that the current is carried away from the carbon at both top and bottom, and owing to this form of construction, and to the excellent contact between the carbon and the lead, very much heavier currents can be taken than is possible with the usual form of joint.

A working drawing of the "Type A" cell is reproduced in fig. 2, in which the lettering of fig. 1 is retained as far as possible. The space between the carbon and the lead shell is only ½ mm. The zinc plate is carried in an ebonite frame, F. The tubes, T_1, T_2, are provided with ebonite unions and rubber washers, W_1, W_2, for coupling to other tubes (the tube T_2 is not shown carried up).

If larger cells are required, this is effected by fitting two or more carbons into one shell, permanently connected in parallel, and the zincs are correspondingly coupled together. Thus the flow of electrolyte to such a compound cell is regulated by a single tube, and the disadvantages of attempting to run separate cells in parallel are avoided. Particulars of single and multiple cells are given in Table I.

The electrolyte is contained in a lead-lined tank, from which it flows down a lead pipe through a cock to a common supply pipe, from which each of the cells is supplied by a tube. The waste from each cell is carried into a common pipe, from which an inverted U pipe is taken to maintain the level in the cells, and this discharges into a lower tank.

TABLE I.—PARTICULARS OF CELLS (NEW DESIGN).

—	Width.	Length.	Height.	Weight (including zinc).	Maximum current with "L" solution. (Continuously.)	Watts.
	Inches.	Inches.	Inches.	Lb.	Amperes.	
Single cell ...	1⅝	6½	9¼	8·8	17·5	26·25
Double cell ...	3¼	6½	9¼	16·5	35·0	52·50
Triple cell ...	5½	6½	9¼	26·8	52·5	78·75
Quadruple cell	9	6½	9¼	36·3	70·0	105·00

NOTE.—The sizes given include terminals, but exclude pipe connections. The current given is for a voltage of 1·5 volts per cell. E.M.F., 2·0 volts.

If the electrolyte has been only so far used as to be good for further action, it can be returned to the top tank by means of a pump. The width of a standard 7-cell battery across the front of the stand is only 25½ in. and the depth from front to back 24½ in. In order to give the necessary head the overall height is 7 ft. 9 in.* For a battery giving a minimum working pressure of 10·5 volts and a power up to about 260 watts continuously, the space required must be regarded as small.

With a given flow of electrolyte an extremely constant current can be maintained up to a certain limit, depending largely, of course, upon the composition of the electrolyte. In the case of bichromate solutions Mr. Benkö recommends the following formulæ:—

ELECTROLYTE "L" FOR ELECTRIC LIGHT, ELECTROLYSIS, &C.

Water	1 litre	35 fluid oz.
Sodium bichromate ...	60 grammes ...	2·1 oz.
Sulphuric acid (concentrated), sp. gr. 1·84 ...	120 c.c.	4·2 fluid.

ELECTROLYTE "P" FOR HEAVY CURRENTS.

Water	1 litre	35 fluid oz.
Sodium bichromate ...	100 grammes ...	3·5 oz.
Sulphuric acid (concentrated), sp. gr. 1·84 ...	150 c.c.	5·25 fluid oz.

ELECTROLYTE "T" FOR TELEGRAPHIC WORK.

Water	1 litre	35 fluid oz.
Sodium bichromate ...	5 grammes ...	1·75 oz.
Sulphuric acid (concentrated), sp. gr. 1·84 ...	2·6 c.c.	0·88 fluid oz.

Potassium bichromate should not be used, as it tends to deposit double sulphate crystals when decomposed, and these block up the pores of the carbon. The E.M.F. with these solutions is 2·0 volts, rising sometimes to 2·05 volts.

About one-fifth to one-third of the zinc appears to be wasted, but this figure, of course, is in excess of the true local action. On open circuit the loss in the Benkö cell is much smaller than in other cells of the acid class, because the flow can be stopped, and then the amount of electrolyte in contact with the zinc is very small. It might be thought that serious local action would take place through the tubes connected to the common supply of the electrolyte on the one hand and to the common waste on the other. There is, of course, a potential difference between the tubes of one cell and those of another, but this is localised by the ebonite unions and rubber washers used for coupling up the pipe work, and so far as could be seen no corrosion of the tubes took place during the six weeks a particular battery of four cells was under test.

* In later designs this copper plate has been abandoned, the terminal being jointed direct to the lead ring.

* In later batteries this height has been considerably reduced.

Fig. 3 shows how the terminal pressure and terminal watts vary as the current is increased. This test was made with solution L.

The tests shown in fig. 4 were made with a similar single cell, using the stronger solution P at a flow of about 1·9 litres per hour. The external resistance was maintained constant, and the fall of current was observed for 15 minutes. The current might have been maintained longer, but the cell became very hot.

Short-circuit tests with the L solution showed momentary currents of 100 amperes at a terminal voltage of 0·5 to 0·6 volt, the current

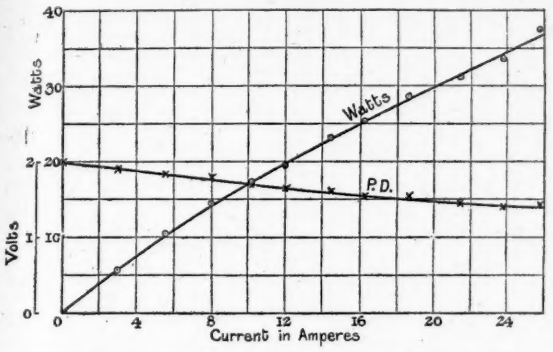


Fig. 3.—Relation of Terminal Volts and Terminal Watts with Amperes.

Type "A" cell. Solution "L."

falling to 80 amperes at the end of 5 seconds. With the stronger P solution momentary currents of 200 amperes were taken at a terminal pressure of 0·5 to 0·55 volt. It follows, therefore, that the internal resistance is well below 0·01 ohm—an extremely low figure. This result is no doubt due largely to the excellent contact between the lead shell and the carbon, both at the top and at the bottom.

TABLE II.—Current Output per Square Foot of Plate.

Cell.	Maximum current continuously per cell.
Benkö, A type, solution L ... 56 a. per sq. ft. of zinc	16 amperes
Benkö, A type, solution P ... 90 a. per sq. ft. of zinc	27 amperes
Lead accumulator (stationary type) { 5 to 6 a. (8-hour rate)	—
Lead accumulator (stationary type) { 25 a. (1-hour rate) per sq. ft. of positive plate }	—

The maximum current obtainable continuously, taking 1·5 volts

TABLE III.—Power per Pound of Cell.

Cell.	Watts per lb.
Benkö, A type, solution L	2·4 (continuously)
Benkö, A type, solution P	4 (continuously)
Lead accumulators (automobile cells) ...	2½ (5-hour rate)
Lead accumulators (stationary, in glass boxes)	½ (8-hour rate)
	1 (3-hour rate)

per cell as the minimum terminal voltage for continuous working, is given in Table II.

The weight of the Benkö battery supplied to me was about 10 lb. per cell, including casing, the electrolyte in the cell and the zinc, but excluding pipe connections. Taking again 1·5 volts per cell as

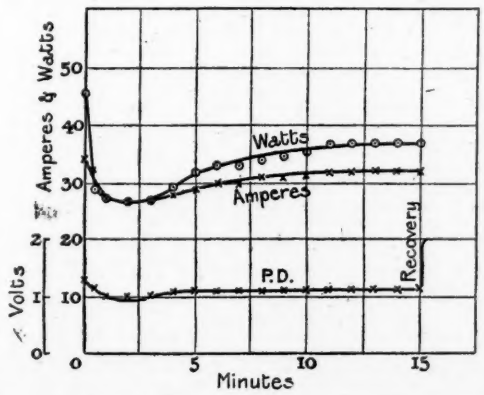


Fig. 4.—Heavy Current Test on Constant Resistance.

Initial current 35 amperes. Type "A" cell. Solution "P."

the minimum terminal voltage we have the results given in Table III, which shows that the power as compared with lead accumulators is high.

At high rates of discharge the figures for accumulators become more favourable, but the Benkö cell also is capable of higher rates for short intervals, and it has the great advantage that short circuits do no harm.

The battery appears to be particularly suitable for use in the laboratory. The charging of ignition cells, electroplating on a small scale, and possibly submarines (owing to the peculiar conditions involved) are fields in which such a battery would prove useful. There is also the electric lighting of yachts having no generating plant.

Since the currents used in telegraphy run merely to some milliamperes, Benkö cells very much smaller than the type A would give the necessary current for telegraphic work. Such cells have been made; they occupy a much smaller space than the usual primary cells, and are equivalent to the accumulator in constancy of E.M.F. and low value of internal resistance. Obviously also they would be much simpler to keep in order than a battery of ordinary bichromate cells.*

In the case of a country house requiring 50 10-C.P. metal lamps, a pressure of 25 volts would be adopted, and for 75 per cent. of the lamps in use at one time a current of 15 amperes would be required. A complete oil-engine and battery installation, excluding the house wiring, will cost, roughly, about £200. If interest on the outlay is taken at 5 per cent., depreciation and repairs at 7½ per cent., and labour only at one hour per day, or 300 hours at 6d., the total cost for 400 units per annum would amount to about 1s. 10d. per unit.

A Benkö battery of 16 or 17 cells would give a working pressure of 25 volts, and as the space occupied would be small, there would be no objection to having the battery in the house, as it is free from smell. The cost would be probably in the neighbourhood of £20.

At wholesale prices and allowing for local action and waste zinc, which is re-sold, I have found that electric energy can be generated continuously with the L solution at a cost of about 2s. per unit, the cost varying with the conditions.

A single cell will give ½ unit, and a battery of 17 cells will give 5½ units before the zincs need be changed. If a house is using 1 to 2 units per day, this means that the zincs are changed once or twice a week. As the operation is very simple it takes very little time. From the point of view of labour the electrolyte is more important than the zinc. If the battery is allowed to flow steadily at a rate of ½ litre per cell, then a 5-hour run would require 9½ gallons.

As far as can be judged the cost of repairs should be very small, and the interest on capital is scarcely worth considering. It follows, therefore, that electrical energy can be generated at about 2s. per unit under favourable conditions, and this cost will vary according to the carefulness of the regulation.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIAN COMMONWEALTH.—The following amendments to the tariff have recently been issued by the Australian Customs authorities:—

Electrical appliances and materials:

	Per cent.
Adapters—Brass or gun-metal	25
Other	10
Collars for telephone receivers, imported separately.	
Plated or otherwise	25
Couplings, ammeter, used in connection with electric lighting—	
If of brass or gun-metal	25
Couplings, arc lamp, automatic—	
Brass or gun-metal	25
Other	10
Holders, lamp (electric light fittings), if of brass or gun-metal	25
Lamps, &c.—	
Reflectors, enamelled iron, for electric arc lamps	15
Roses, ceiling, for electric light fittings—	
Brass or gun-metal	25
Other (being wholly or partly of metal)	10
Rosettes, wall, with hooks for taking wires—	
Brass or gun-metal	25
Other	10
Sleeves, connection, made of metal—	
If of brass or gun-metal	25
Terminals, electric—	
Brass or gun-metal	25
Other	10
Wall plugs—	
Brass or gun-metal	25
Other	10

* For work of this kind the flow need only be very slow. Since this paper was written a type of Benkö cell has been developed in which the compartment outside the carbon is filled with very strong electrolyte and the inner compartment is merely filled with water; circulation of the electrolyte then takes place by diffusion, there being no supply and waste pipes, or pressure reservoir. Probably cells of this kind will be the most suitable for telegraphy and for miners' lamps where only small currents are required.

	Per cent.
Lamps and lamp ware—	
Gallery shade, being an attachment for an electric lampholder to hold the globe—	
If of brass or gun-metal	25
Otherwise	15
Shade carriers for fixing on gas brackets and lamps.	
If of brass or gun-metal	25
Shades, glass	20
Steam turbine parts not commercially usable for other purposes, and not specifically mentioned in the tariff	Free
Electrolier ball fittings:	
Of brass or gun-metal	25
Other	10

FINLAND.—The Board of Trade are informed by H.M. Consul at Helsingfors that all electrical machinery and apparatus entering Finland from abroad is in future to be charged with Customs duty at the following rates:—

	Finnish marks per 100 kg.
When weighing up to 2,000 kg., and made mostly of iron...	47·10
When weighing more than 2,000 kg.	14·70

All such machinery, if weighing not less than 100 kg., was formerly dutiable at the rate of 14·70 Finnish marks per 100 kg.

N.B.—25 Finnish marks = £1.

PATENTS EXPIRING IN 1911.

(*Continued from page* 864.)

28,275. November 30th, 1897. "Electric railways, &c." W. M. BROWN.—The magnet on the vehicle has two windings of high and low resistance in shunt with and in circuit with the motors. When the line current is cut off, the magnet may be excited from a battery thrown in by a switch. An additional brush connected to the return short circuits any road switch left alive, and may operate a cut-out.

29,069. December 8th, 1897. "Syntonic telegraphy." O. J. LODGE and A. MUIRHEAD.—Relates to a system of signalling by Hertzian radiations in which the receiving areas are bridged by parallel circuits including a coherer, an inductance, a condenser and a receiving instrument and battery. These apparatus are grouped in various ways, including a Wheatstone bridge system, the coherer, inductance and condenser being arranged in two parallel circuits in one arm of the bridge. The receiver is across one diameter, and the battery across the other. A rotating cylindrical switch is described for automatically varying the circuits of the coherer, so that the coherer is (1) Connected to the receiving areas; (2) Connected to the receiver signal circuits; and (3) Connected to a decohering apparatus, either mechanical or electrical. An arrangement of the apparatus is shown in which the areas are provided with a spark gap and latch, which is opened for transmitting and closed for receiving. The apparatus is provided with a switch lever which in one position (receiving) closes the coherer contacts, and connects the coherer to a rotating switch, while in the other position (transmitting), it opens the above circuits, and closes the induction coil and latch circuits. The signalling is preferably done through a relay circuit, either by key or automatic transmission. The coherer may be of any desired form, and is preferably contained in a metal box, the contacts being completed by wires which are withdrawn from the box or are provided with ends which plug the holes in the box.

29,306. December 10th, 1897. "Wireless telegraphy." WIRELESS TELEGRAPH AND SIGNAL CO. and G. MARCONI.—Relates to improvements on the apparatus described in specification 12,039 of 1896. The coherer enclosed in a thick metal box provided with one or two openings through which connection can be made. Only one opening is employed when one coherer terminal is connected to the case itself. The opening or openings is or are closed by a shutter or shutters operated by the lever which carries contact clips connected to earth through a strip and contacts connected to the insulated area through the strip and flexible wire. The position shown is for transmitting, the openings being closed and the spark gap balls being in circuit. For receiving the lever is reversed, when the coherer is placed in circuit. When only one aperture is employed the contacts on the lever are suitably modified.

(*To be continued.*)

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,678. "Electrical appliance for boiling water." A. GOSSLAND. May 15th.

11,690. "Electrical switching apparatus." F. J. WALTON. May 15th.

11,711. "Electrically-insulated fish-joints for railway rails." W. R. SYKES INTERLOCKING SIGNAL CO., LTD., and G. H. SYKES. May 15th.

11,738. "Continuous-speed cones for dynamos with invariable speed of rotation." L. VAN CELST. (Convention date, May 14th, 1910, Belgium.) May 15th. (Complete.)

11,740. "Electromagnetic switch." H. W. SHEEHY. May 15th.

11,775. "Methods of and means for charging the frequency of alternating currents." A. M. TAYLOR. May 16th.

11,794. "Machine for making electrically-welded chains, rings, and the like." M. B. RYAN. May 16th. (Complete.)

11,795. "Electric heating apparatus." B. BINGLEY. May 16th.

11,811. "Spark plug." F. E. HARPST. May 16th.

11,841. "Soldering bodies for use in soldering electric conductors and the like." C. E. EGNER. May 16th. (Complete.)

11,872. "Electric arc lamps of the open-arc type." F. R. BOARDMAN, R. V. BOARDMAN and F. BOARDMAN. May 17th.

11,896. "Electrical connections." A. J. BONNELLA. May 17th.

11,898. "Processes and apparatus for magnetically separating materials." S. BRUCK. (Convention date, May 17th, 1910, Germany.) May 17th. (Complete.)

11,899. "Variable inductances." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and H. J. ROUND. May 17th.

11,906. "Depolarisers for galvanic cells or batteries." CHEMISCHE FABRIK GRIESHEIM ELEKTRON. (Convention date, October 10th, 1910, Germany.) May 17th. (Complete.)

11,932. "Electric radiation furnaces." E. C. R. MARKS. (Gebruder Siemens & Co., Germany.) May 17th. (Complete.)

11,944. "Means applicable for use in locking electric incandescing lamps in their holders." J. C. A. GEERTZ. May 17th.

11,950. "Shield or protector for telephone receivers." W. I. BAXENDALE. May 18th.

11,951. "Coal miners' electric safety lamp." S. GOLLEY. May 18th.

11,964. "Process for preparing tungsten and the like metal filaments." G. LUDECKE and IMPERIAL LAMP WORKS (BRIMSDOWN), LTD. May 18th.

11,976. "Switches for tramways." D. CARNEGIE and S. C. GLADWYN. May 18th.

11,999. "Method of mounting, receiving and transmitting apparatus in radio-telegraphic stations." E. GIRARDEAU. (Convention date, May 28th, 1910, France.) May 18th. (Complete.)

12,003. "Electric incandescent lamps." G. W. PRIESTMAN and C. E. LEE. May 18th.

12,011. "Magneto electric machine." H. C. H. SMYTH. May 18th. (Complete.)

12,017. "Silk extension shade for use with electric or gas opal shades." P. D. COLLINS. May 18th.

12,019. "Manufacture of electric accumulator electrodes and means for use therein." R. PAPE. May 18th.

12,024. "Manufacture of electrodes for electric arc lamps." A. BLONDEL. (Addition to No. 6,060, of 1903.) May 18th. (Complete.)

12,040. "Regeneration of the hitherto waste products of galvanic cells or batteries." CHEMISCHE FABRIK GRIESHEIM-ELEKTRON. (Convention date, June 3rd, 1910, Germany.) May 18th. (Complete.)

12,077. "Variable ignition control attachments in connection with magneto-electric machines." G. B. MEENAN. May 19th.

12,102. "Trolley-bases for electrically-propelled vehicles." E. M. MUNRO and RAILLESS ELECTRIC TRACTION CO., LTD. May 19th.

12,104. "Device for welding the metal-filament of electric incandescent lamps." E. MAJERT and W. GLADITZ. May 19th. (Complete.)

12,117. "Semi-automatic telephone exchange systems." SIEMENS BROS. AND CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 19th. (Complete.)

12,118. "Electrically controlled valves." A. H. NICHOLSON and A. W. BROOKING. May 19th.

12,134. "Electric motor arrangements for driving clocks and the like." H. CREESE and L. J. ARON. May 19th.

12,135. "Automatic telephone instrument." S. A. BHISEY. May 19th.

12,142. "Disinfection apparatus, to be used especially for telephones, water-closets, razors and the like." B. PARLAGI. (Convention date, May 20th, 1910, Germany.) May 19th. (Complete.)

12,145. "Mine exploders." STERLING TELEPHONE AND ELECTRIC CO., LTD. (Schaffler & Co., Austria.) May 19th.

12,168. "Ships' engine-room telegraphs." T. McM. CASKIE. May 20th.

12,175. "Telephone signalling systems." C. H. ELLISON and C. M. JACOBS. May 20th.

12,177. "Cord-grip electric lampholder." C. E. H. S. WALTER. May 20th.

12,197. "Dynamo-electric machinery." P. MOLLOY. May 20th.

12,200. "Telephone mouth-pieces." G. S. BENNETT. May 20th. (Complete.)

12,225. "Plug and socket electrical connections." A. P. LUNDBERG, G. C. LUNDBERG and P. A. LUNDBERG. May 20th.

12,239. "Process for the utilisation of the energy of the transverse oscillations of the wind and waves and motors for this purpose." J. JAAKSON. May 20th.

12,254. "Transmitters for wireless signalling." R. S. P. HORNBY and H. A. MADGE. May 20th.

12,255. "Transmitters for wireless signalling." R. S. P. HORNBY and H. A. MADGE. May 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

ELECTRIC LIGHTING OF RAILWAY CARRIAGES AND OTHER VEHICLES. Electric and Ordnance Accessories Co. and W. Seal. 2,088. January 27th.

BONDING DEVICES FOR ELECTRIC CABLES AND ELECTRIC FITTINGS. S. W. Martyn. 9,921. April 28rd.

ELECTRIC MEASURING INSTRUMENTS HAVING MOVABLE COILS. G. W. Harris. 10,048. April 25th.

PROCESS FOR MAKING INSULATED ELECTRIC CONDUCTORS. P. Torchio. 10,160. April 26th. (May 4th, 1909.)

ELECTRIC MOTOR STARTERS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 10,191. April 26th.

COIN-OPERATED MECHANISM FOR SUPPLYING ELECTRICITY. C. Kretz. 10,334. April 27th.

SUPPORTS FOR ELECTRIC CONDUCTORS. E. B. Koopman and Pontelic Welding Patents, Ltd. 10,693. April 30th.

ELECTRIC HEATING MACHINES. E. B. Koopman and Pontelic Welding Patents, Ltd. 10,694. April 30th.

MANUFACTURE OF FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. F. Harrison. 10,871. May 3rd.

EXHAUSTION OF INCANDESCENT ELECTRIC LAMPS. F. Harrison. 10,872. May 3rd.

ELECTRICALLY HEATED SOLDERING IRON OR TOOL. Veritys, Ltd., and W. G. Pipkin. 11,088. May 5th.

METALLIC FILAMENTS FOR ELECTRIC LAMPS. J. Kitsee. 11,415. May 9th.

PROCESS FOR THE AUTOMATIC POLARISATION OF FLUID CONDENSERS IN AN ELECTRIC WELDING APPARATUS. E. Presser. 15,033. June 22nd. (Addition to No. 14,859 of 1910.)

MEANS FOR WORKING ELECTRIC MOTOR AND LIKE CONTROLLERS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 17,235. July 20th.

SWITCHES FOR WORKING WITH DYNAMOS, ACCUMULATORS AND THE LIKE. S. L. Price. 18,869. August 10th. (November 14th, 1910.)

COIN CHUTES FOR COIN-FREED TELEPHONE BOXES AND THE LIKE. F. W. W. Breakell. 18,965. August 12th.